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The Oil Man's Calendar

FEB.	
4	**National Oil Scouts and Landmen's Association, Dallas, Texas.**
15–18	**American Institute of Mining and Metallurgical Engineers, New York.**
APR.	
8– 9	**American Petroleum Institute, Division of Production, Eastern District, Wm. Penn Hotel, Pittsburgh.**
7– 9	**American Association of Petroleum Geologists, Fort Worth, Texas.**
MAY	
5– 6	**Petroleum Electrical Association, Houston.**

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The Changing Panorama

Some East Coast Relief in Sight — If

THE shortage of petroleum in the East Coast district has become very acute, but relief to some degree is in prospects for the near future—provided several "ifs" do not interfere. Unfortunately, this prospective relief cannot fill all requirements this winter.

Immediate prospective relief for the Atlantic Seaboard is due to come in three forms: (1) some additional tank cars to be released from the Middle West and Southwest for Eastern service, following extension of gasoline rationing in those areas; (2) increased volume of oils delivered in the East by tank cars in consequence of shorter hauls made possible by first leg of 24-inch pipe line going into operation in January; and (3) increased oils delivered through completion of other pipeline projects, including reversals, looping, relocation and other work.

Both of the first two prospects, however, may be limited by congestion of railway traffic, by deficiency of locomotives in the Eastern region, and by reduced efficiency resulting from necessity of repairing over-worked cars. Recently rail shipments have been averaging 100,000 barrels per day less than the peak of 856,710 barrels daily reached in the week ended September 19. An increasing number of cars have been forced to repair shops because of continuous operation at too-high speeds, and these plants now are unable to handle all the work needed in quick order. It is feared the situation may become more acute rather than show improvement. Railroad men have blamed some train wrecks on tank cars operating at excessive speeds and in poor condition. ODT has asked tank car owners to install snubbers in the spring clusters of the trucks of the cars, to prevent them from bouncing so much at high speeds. Trying to run 60 miles an hour, tank cars have been hopping around too much. Snubbers being installed are steel spring coils, less resilient than the springs they replace. But cars are out of service as much as two days for the substitutions. The decline in rail deliveries should be checked by shorter hauls afforded by completion of the big-inch pipe line as far as Illinois, but it is problematical whether shipments will increase materially because of railroad congestion and cars needing repairs. At best a net gain of 100,000 barrels daily in Eastern receipts is anticipated, which would still leave the territory short of needs under rationed basis.

Not until the big-inch pipe line is completed all the way to the coast will conditions be fairly satisfactory. This will not be until early summer. Completion of the line will be of material help, but even then other pipe lines and also tank car shipments must continue at high levels. Even the benefit of this transportation system must be prefaced with several "ifs." Much of its capacity may be devoted to export military requirements, because the Atlantic Seaboard is much closer to Great Britain and Africa than Gulf Coast ports. Furthermore, increasing military demand in face of declining production ability raises the question of whether the industry can produce all the oil that will be required if the war continues several more years. Of course, an actual shortage of oil a year or two hence will be shared by the nation as a whole, instead of being limited to the East Coast because of the latter's transportation troubles.

Moving through the line at a rate of about three miles an hour, a barrel of oil entering the big-inch pipe line at Longview, Texas, will not reach the Atlantic Seaboard terminal, 1388 miles distanct, until almost 20 days later.

The 24-inch pipe will hold 3100 barrels of oil in every mile. Therefore, approximately 4,300,000 barrels will be required to fill the system.

Well Abandonments Increasing

ABANDONMENT of producing oil wells has increased sharply in recent years, especially in Texas. Average annual abandonments for the nation for the years 1941 and 1942 will be approximately 10,605, in contrast with an average annual abandonment of 7728 wells in the preceding five years, according to a study made by the Interstate Oil Compact Commission.

Thus the national abandonment rate during the last two years has been 2877 wells per annum greater than in the preceding five years, or more than 25 percent.

The commission shows the yearly rate of producing oil well abandonment since 1936, exclusive of Colorado and Wyoming, to be as follows:

1936	6,730
1937	8,847
1938	6,723
1939	7,491
1940	8,851
1941	10,799
1942 (first half)	5,206

The commission's survey indicated that approximately 225 million barrels of reserves were lost by abandonments during the past 6½ years.

Although Pennsylvania for years had the largest rate of abandonments, as to be expected, figures contained in the report show that Texas during 1941 and the first half of 1942 was abandoning wells much more rapidly than even Pennsylvania. The trend of producing well abandonments in Texas has risen sharply. There were 1320 producing wells abandoned in Texas in 1938, 1894 in 1939, 1342 in 1940, 3670 in 1941 and 1771 in the first six months of 1942.

OPA Release Two Million New Tires

OPA reports that 1,438,672 new passenger car tires and 1,709,209 inner tubes were released during the nine months ended September 1. In addition to these new passenger tires, recapping accounted for an additional 3,171,712 casings. This is at an annual rate of close to 2 million new passenger car tires and slightly less than 4 million recaps, or a combined total of 5¾ million tires of all kinds per year. This compares with the anual "replacement" sales of about 30 million new tires in normal times.

OPA's report says 9,018,228 new passenger car tires and 9,870,864 inner tubes were on hand September 30. However, this does not mean a 4½-year supply on the basis of 2 million new passenger tires rationed this year. The tempo of releasing new tires is expected to increase shortly, as more existing tires reach the end of their service life and additional cars are made eligible for new casings as a result of national mileage rationing.

Recapping should increase even more sharply. In addition approximately 10 million idle tires have been turned in by motorists.

During the first nine months of the year, 2,414,456 truck tires, 1,805,175 truck recaps and 2,283,556 truck tubes also were rationed.

Turn About: Japs Make Gasoline from Rubber

WHILE the American technologist strives to convert crude oil into an ingredient for synthetic rubber, the little man in the Japanese laboratory is wrestling with the problem of converting the natural rubber hydrocarbon into high-octane gasoline.

At least that is the claim of the island empire, whose radio gives the world a report each month. The world is not overly impressed with radio Japan, still the technologists of the allied nations realize that natural rubber can be converted to motor fuel.

For whatever it is worth here is the substance of the claims of the Japs:

A factory near Kuala has been built for converting Hevea rubber by dry distillation, after which the low-boiling unsaturated hydrocarbons are used for alkylation and hydrogenation. The claim is that 100 tons of high-octane gasoline is being produced per month.

The inconsistency of all this is the proposition that men would turn to the rubber molecule as a source of gasoline, when in the conquest that brought rubber there also were oil fields that came under subjugation. It would seem that even the Japanese technologists would work with oil rather than the latex of the Hevea tree in searching for high-octane gasoline.

Synthetic Rubber Here to Stay

IT IS virtually certain that synthetic rubber is here to stay—that the United States will never go back to natural rubber. This forecast is based on the indicated possible low cost of the substitute product, coupled with advantages that synthetic is being found to have over natural rubber. Already, almost all essential rubber articles can be made from the synthetic product, including hundreds of products used by the armed forces, and additional synthetic types are being developed for special purposes where natural rubber still has some advantages. When synthetic tires were introduced in June, 1940, as a national defense measure, the synthetic displaced only about 50 percent of the natural rubber, but now there is highway testing of tires whose rubber content is 99.84 percent synthetic, with results under some conditions better than given by natural rubber tires. Oil industry chemists are predicting synthetic rubber tires that will run 100,000 miles.

Within 2 years after being shut off from rubber trees in the East Indies, the United States will be filling 90 percent of its rubber needs synthetically. Within the laboratories of the oil companies are the miracle men who have made this prospective achievement possible.

Five Rubber Firms Pool Resources

RUBBER Reserve Company has made a contract with National Synthetic Rubber Corporation for the operation of a new government-owned synthetic rubber plant to be built in Kentucky by Defense Plant Corporation, a subsidiary of Reconstruction Finance Corporation. The plant's output will be made generally available and allocated by the government, together with the products of other government-owned synthetic rubber plants.

Formed for the specific purpose of operating the new government-owned plant, National Synthetic Rubber Corporation is jointly owned by five long-established rubber companies which manufacture a wide variety of products ranging from motor car tires to coated abrasives and including scores of articles of vital importance to the war effort. The five companies participating are: Goodall Rubber, Inc., Hamilton Rubber Manufacturing Company, Hewitt Rubber Corporation, Lee Rubber & Tire Corporation and Minnesota Mining & Manufacturing Company. Although vigorous competitors in one or more fields of their activities, the companies have pooled substantial amounts of capital and have provided from their organizations a technical staff of ability and experience.

Cheering Note—Fewer Questionaires

THE chief statistician of the War Department's supply service has thrown out no less than 236 of 241 questionnaires which the department was preparing to send out to business asking for information.

This is one reaction from the Senate's recent battle against too many questionnaires, which made some government agencies look pretty silly. Be of good cheer, there might be others that will take the suggestion.

Prospects for Casing Salvage Improved

RECENT development of a new casing-pulling procedure that reduces costs materially, coupled with a salvage job in which 30-year-old pipe was found to be in surprisingly good condition, may make it desireable for the industry to salvage thousands of tons of casing from abandoned wells if the steel shortage continues acute.

The new casing-pulling procedure, which Stanolind Oil & Gas Company is donating to the industry without patent or royalty fees as a war contribution, brings costs into line with new pipe prices, or approximately half previous salvage costs. It is extremely simple, and requires no new tools. Details of the method can be found in THE OIL WEEKLY of December 21, 1942.

Successful recovery of 30-year-old casing in surprisingly good condition has netted Magnolia Petroleum Company 4560 feet of pipe. Some of the mill scale was still clinging to the outer surface of the pipe.

The pipe was taken from Magnolia's Schmoker 1, in the Burkburnett field of North Texas, which was completed in June, 1912, and abandoned in late August, 1942. The original hole contained 191 feet of 12½-inch casing, of which 51 feet were recovered. A total of 861 feet of the 955 feet of 10-inch casing originally run was pulled successfully. All of the 1781 feet of 8¼-inch, and all the 1867 feet of 6⅝-inch casing originally run was recovered. Thus a total of 4560 feet of the 4794 feet of casing originally used was recovered.

The satisfactory condition of this old casing leads to the conclusion that it may be advantageous for the industry to salvage thousands of tons of casing from the hundreds of wells being abandoned because they are no longer profitable, especially in areas where highly corrosive conditions do not exist. The reduced costs afforded by Stanolind's new casing-pulling method enhances the possibilities of doing this within margin of reasonable expenditures.

To meet the ever-soaring demands of aerial warfare production of aviation gasoline has been doubled, tripled, quadrupled. By the end of 1943 it is estimated that the total capacity of catalytic cracking plants alone will be one million barrels a day. As recently as 1939, catalytic cracking throughput was only one million barrels a month.

America's Foundation Stone

By J. Howard Pew
President, the Sun Oil Company

When J. Howard Pew, president of the Sun Oil Company addressed the War Congress of American Industry in New York a short time ago, he put into pungent paragraphs a thought which should appeal to every American, whether he be a member of a labor union, a representative of management, or a part of what is termed "the public" which usually means both employee and employer and those who serve or are served by employees and employers. Mr. Pew did not write this as an editorial but we feel that he will forgive us for giving his sound observations such additional circulation as lies within our power. What we reproduce below is only a part of a most interesting address but it is a part which should be reproduced as something vital to the American Way.

"SEVERAL times during the last twenty years I had occasion to make careful studies as to why our workers produce three times as much as do the workers in Europe. I thought, perhaps, we might be smarter than Europeans, but found we are not. We need only recall that our factories are largely manned by the sons and daughters of Europe. I inquired whether our natural resources were responsible for our high living standards, but found they were not. China and Russia, as well as many countries in South America and Africa, have greater natural resources than we, yet their living standards are even below those of Western Europe. I investigated to ascertain if our production achievements were in some way due to our use of machines, mass production or advertising, and found this was true in part, but that, nevertheless, these also were available to the peoples of Europe. In fact, the steam engine and the Industrial Revolution first emerged in England and spread to the European continent before reaching America.

"In short, the reason American industrial wheels turn around so much faster than those in Europe I finally found in a single word—*initiative*. American industry has it. European industry, generally speaking, lacks it. Initiative is the key to the great difference between American and European industrial production. Initiative is the psychological drive that makes the wheels of American industry go round.

"Initiative is an intangible thing. It is not something that you can give to a man. It cannot be bought in stores; nor can it be acquired from books. Initiative is an attribute of the spirit, springing out of certain urges within mankind. A yearning for the security of one's family moves men to exert themselves beyond the requirements of mere survival. Men, too, desire recognition from their fellow men. Pride of work, pride in the superiority of their product, the doing of a better job than the other fellow, prestige of position—all these are aspirations that motivate men's actions. So, too, is the urge to improve our material well-being: to eat more or tastier food, wear better clothing, live in more comfortable homes.

"When opportunity exists for the satisfaction of these urges, men develop what we call initiative. Initiative finds its expression in competition; and competition is possible

only where there is freedom of choice and action. Where men are denied freedom of choice and action, their initiative dries up and gives way to inertia and inefficiency.

"In Europe the initiative of men has been throttled by centuries of oppression, regimentation, socialization and cartelization. By regimentation we mean the usurpation by Government of those activities which should be left to business and industry. By the European cartel system we mean conspiracies among groups of industrialists and business men to control prices and production. Neither the cartel system nor regimentation offer any reward for reducing costs or improving products. Under these systems incentive for initiative is destroyed. Freedom of decision and choice are so restricted and the opportunity for improving one's lot made so difficult, that men lose heart and give up the job. The worker, knowing that his place in life is fixed, does what he has to do to live and no more.

"Government regimentation and industrial cartels are Siamese twins of evil, for one is just as destructive of industrial production as is the other. In contrast to these limitations on initiative and originality, the American enterpriser has been largely free of all dictation save that of his individual genius and initiative. Here the door of opportunity has been kept open for every man, irrespective of creed, class or color. Here man has never been hedged in by class distinctions. The only aristocracy that counted was that based on talent and hard work. Here men found that when they succeeded they were rewarded in proportion to their achievements. Here we have had for the most part free men and free markets. This is what we mean when we speak of the American way of life. And this is why the American way of life produces three times as much goods per worker as do the European systems. . . .

"There are planners in Washington who take it for granted that we are going to win this war, and are meanwhile conspiring, under the guise of the emergency, to destroy our American way of life. I agree with these planners that America will eventually win the decision over its enemies. I completely disagree how this decision will be gained. Initiative will win the war, not regimentation. This is no time for experiments in business reform. Unfortunately the socialistic planners of the New Deal are receiving encouragement from many men whose faith in the worth of the American system is beyond challenge. Against their better judgment, they are willing to accept mild doses of regimentation on the ground that by so doing we shall be spared more drastic restrictions. These men do not know history. Power feeds on power; and the bureaucrat is never satisfied, even though he may formerly have been a business man.

"Then we have men who, while they are aware of all this, have nevertheless been led to believe that the only way to fight Hitler is to adopt Hitler's methods. This is utter nonsense. The belief that totalitarianism is synonymous with industrial efficiency, is the great myth of our age. Germany has always failed even to approach our industrial production. Of course, totalitarian countries rigidly restrict and direct their people in time of war, because their form of Government has already destroyed their initiative.

"The surest way for us to lose this war is to ape Hitler. The surest and quickest way to win this war is to place our faith in American initiative. Keep restrictive policies to the minimum of absolute necessity. Cut away the ropes of bureaucratic red tape now hamstringing industry. Give management and labor a chance to exercise initiative by reopening the door of opportunity. Do these things, and the output of war materials will soar to heights that even today would be called fantastic. Fail to do them, and we will lose initiative. Lose initiative, and we will lose production. Lose production, and we will lose the war. Lose the war, and we will lose our freedom. Lose our freedom, and we will become German or Japanese slaves."

☆ ☆ ☆ ☆ WASHINGTON ROUNDUP ☆ ☆ ☆ ☆

By B. F. LINZ
Washington Correspondent

THE Eastern gasoline situation and the prospects of sharp new reductions in ration allowances in the event of expansion of military activities in the African or European theatres of war were the major subjects of discussion in Washington oil circles in what otherwise was a quiet holiday week.

A full week of study of the situation by the several agencies involved—PAW, OPA and ODT—failed to develop any new program which would adequately deal with the situation after a 60-hour suspension of gasoline sales in the Eastern States.

Even the resignation of OPA Chief Leon Henderson did not quiet criticism of the war agencies, and political observers commented that this was the first fiasco in government plans for which the administration in Washington could not proffer at least a believable alibi.

Blame for the crisis was attributed to the need to supply the African invasion forces, but the question was raised why, if the invasion was planned over a period of months, as contended, no provision was made to provide oil supplies without draining the East.

Congressional investigations of the matter are a foregone conclusion and, in fact, the Senate special oil committee will begin hearings in advance of the new session and the House oil subcommittee probably will get under way by the middle of next month.

Following two conferences between Stabilization Director James F. Byrnes and Ickes, Davies, Henderson and Eastman, it was announced that steps had been taken to deal with the situation which could not yet be disclosed and that representatives of the railroads had been invited to meet with the heads of the agencies December 29 to discuss means of increasing deliveries.

Entering into the spirit of the season, Uncle Sam made a nice Christmas present to his next-door neighbor, Mexico, in the shape of a reciprocal trade agreement in which that country is given permission to ship in as much crude and fuel oil as she can sell here at one-half the excise-tax rates on imported oil fixed by Congress.

For several years given less than four percent of the import quota set up on oil imports under the Venezuelan trade agreement, Mexico, which expropriated the properties of American and British oil companies in 1938 and precipitated a controversy which even yet has not been settled to the satisfaction of all the companies, is given an even better break than was Venezuela—but probably more because of our war need for oil than any spirit of forgiveness on the part of the State Department.

No Solution Found to Eastern Oil Supply Problem Yet

Unabated Criticism Presages Eastern Oil Investigation

Trade Agreement With Mexico Cuts Import Taxes 50%

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TANKERS: Contracts for construction of 24 coastal tankers were announced by the Maritime Commission December 23.

Twelve of the vessels will be built by Gray's Iron Works, Inc., Galveston, Texas, and the other 12 by the Marine Maintenance Corporation, Bayonne, New Jersey, both of which are now constructing similar ships for the commission.

The tankers will be 220 feet in length and of 1600 deadweight tons, and are to be delivered into service between June and December, 1943.

☆

BRANCHES: PAW division representation in Tulsa and Pittsburgh was elevated to the status of district branch offices this month, it was announced by Davies December 23.

The branch office in Pittsburgh is located in the Benedum-Trees building and will house Virgil Howyer of the natural gas and natural gasoline division, and Henry W. Fuelhart of the production division.

The Tulsa office is in the Beacon building, with O. C. Brown of the production division, Mark S. Patton of the natural gas and natural gasoline division, and Silas R. Clinkscales of the materials division.

Davies also announced that the Chicago district office has been moved to Room 1200 Blum Building, and said that other division representatives will be stationed at branch offices as soon as the transfer of personnel can be arranged.

Cheerless Outlook for Gasoline and Heating Oil Confronts East

A CHEERLESS outlook for gasoline and heating oils confronted motorists and home owners in the 17 states and District of Columbia comprising the initial rationed area, as officials of PAW, OPA, ODT and Office of Stabilization scurried around looking for a solution to the problem of making a little oil go a long way.

With the groaning and straining of a couple of professional wrestlers voicing a wonderful fight, the OPA on December 18 halted all gasoline sales in the area except on T coupons while it developed what Henderson said would be an "integrated plan" to handle the gasoline problem—and come up 24 hours later wtih a cut in the value of B and C coupons from 4 to 3 gallons, saving all of 25,000 barrels a day.

The net effect of this, on the face of it, would be to reduce excess consumption, placed by Ickes in November at 139,000 barrels a day, to 94,000 barrels, 20,000 barrels previously having been saved by reducing A coupons from 4 to 3 gallons.

The announcement which permitted a resumption of gasoline sales on December 21 also disclosed that a policy of "strict enforcement" of the rationing regulations had been adopted and, said Henderson, "this goes for the industry, wholesale and retail dealers, and consumers," and, further, that suppression

of the "black market" in gasoline would be vigorously sought.

Gasoline sales were suspended for 60 hours, and the East got a taste of what public transportation would be like if motorists were put off the road. The paucity of results from OPA's deliberations over that period were seen as exemplifying the difficulties of finding a method of rationing which would save the oil necessary without (1) disorganizing all life and activity and interrupting war production or (2) irritating the public to the point of rebellion.

The White House issued another statement, equally pessimistic as to the future but disclosing that some progress was being made in dealing with the problem.

The heads of the several agencies, it said, reported the steps taken to meet the situation and "as a result of the exchange of views other action will be taken as to which no statement can be made at this time.

"Because the increase or even the maintenance of the supply of fuel oil and gasoline in the Eastern district is dependent upon increased deliveries by the railroads, heads of some of the carriers will be invited to come to Washington next Tuesday to confer with Justice Byrnes and the heads of the three agencies primarily involved in the control of petroleum products.

"Director Byrnes stated that after hearing the report of the heads of the agencies involved, he had no reason to change the opinion expressed two days ago that there was no hope of any increased allotment of petroleum products for industries or individuals and that the situation demanded the most stringent economy by every user of such products."

During the week Henderson announced that issuance of B and C rations would hereafter be handled under a "new and tougher" policy and that few of the persons affected by the reduction in coupon value would be given additional rations to make up the loss.

In the only move taken so far to relieve the complaints of the public, Henderson increased the value of heating-oil coupons by 10 percent in 13 midwest states where subnormal temperatures have prevailed for more than a month, and promised the East, which had suffered a cold wave, that if the unseasonally low temperatures continued over a long period consideration will be given to some measure for relief.

The increase in coupon value will apply to Ohio, Kentucky, Illinois, Michigan, Indiana, Missouri, Kansas, Minnesota, Wisconsin, Nebraska, North

[*Continued on page 40*]

Fifty Percent Import Tax Cut Given Mexico in Expropriation Truce

YEARS of controversy over the expropriation of American oil properties became a closed chapter and the "all is forgiven" flag was hung out December 23 in a reciprocal trade agreement with Mexico in which the 50 percent cut in import-oil taxes accorded Venezuela under a similar agreement was extended to Mexican crude petroleum and fuel oil, but without any quota restrictions.

In addition, the one-half-cent-per-gallon tax on liquid petroleum asphaltum, including cutbacks and road oil and the similar tax on kerosine are cut to one-fourth cent.

In justification of its action in abandoning quota limitations on imports of Mexican oil, the State Department explained that during 1940 and the first nine months of 1941 imports from Venezuela, the Netherlands possessions and Colombia, the chief beneficiaries under the Venezuelan agreement, were almost entirely within the quotas assigned to those countries and therefore entered at the reduced rate of tax, while only 15 percent of the imports from Mexico in 1940 and 27 percent of those in the first nine months of 1941 were within the quota, and the remainder were subject to the full tax.

While the department did not go into the 1942 situation, Treasury figures released prior to a prohibition upon their issuance because of their military significance, showed that up to September 26, last, only 336,130,696 gallons out of a quota of 2,082,574,771 gallons had been imported from Venezuela and 259,190,892 gallons out of a quota of 630,097,196 gallons from the Netherlands possessions. Colombia filled its quota of 94,662,490 gallons in July, but Mexico had filled her quota of 150,-868,343 gallons in May.

"In 1940," the State Department said, "the tax of one fourth cent per gallon on imports within the quota was equivalent to 14 percent ad valorem on imports of crude petroleum and 12 percent on imports of fuel oil and topped crude. The full tax of one half cent per gallon was equivalent to 29 percent on crude petroleum and 17 percent on fuel oil and topped crude.

"In 1939 United States imports for consumption from Mexico were 1,728,-000 barrels or considerably less than half the annual average imports from that country before expropriation of properties of foreign oil companies by Mexico in 1938. In 1940, however, such imports from Mexico increased to 15,-381,000 barrels and they amounted to 9,171,000 barrels in the first nine months of 1941. Most of Mexico's exports of petroleum in 1940 and nearly all in 1941 were shipped to the United States.

"Total combined imports of crude petroleum, topped crude and fuel oil for consumption in the United States increased from about 36,000,000 barrels in 1939 to 69,000,000 barrels in 1940 and totaled 57,000,000 barrels in the first nine months of 1941. Petroleum processed at refineries in the United States increased from 1.2 billion barrels in 1939 to 1.4 billion barrels in 1941—the highest figure ever recorded.

"Exports of petroleum and petroleum products, including fuel oil, are ordinarily about 15 percent of United States production and several times as great as imports. In the first two years of the war, however, United States exports declined and imports increased so that in the first nine months of 1941 this country was for the first time a net importer of petroleum and fuel oil.

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Pike Has Background For OPA Price Job

APPOINTMENT of Sumner T. Pike as special advisor on petroleum matters for OPA, for the purpose of settling the long-pending question of whether crude oil prices should be increased (The Oil Weekly, December 21, 1942, page 13), is being received favorably by the oil industry.

Pike is well acquainted with oil leaders, can speak their language, and has full knowledge of the industry's problems. His broad experience in analyzing and appraising oil properties, and his recent work as a Securities and Exchange Commissioner, where he delved into the financial setup and earning capacity of numerous oil companies, provides a basis for passing judgment on crude price adjustments.

Pike has maintained intimate contact with the oil industry over a long period, being a member of AAPG, AIME and API. He is a fairly regular attendant at their annual meetings. As a partner in Case, Pomeroy & Company, Pike at one time was associated with E. DeGolyer, now assistant deputy administrator for Petroleum Administration for War, in the ownership of The Felmont Corporation, a producing unit. Both have since parted with their interests. Pike made a study of oil findings for the Temporary National Economic Committee of a few years ago. More recently he has been with SEC.

Ickes Reports on Oil Achievements During First Year of War

A COMPLETE report of the activities of PAW and Department of the Interior in the first year of the war was made public December 23 by Secretary Ickes, who devoted a considerable part of the document to the problems of oil.

"One of the greatest single factors in the fighting of the war is oil," he said. "A large part of the tonnage of expeditionary forces, including their transportation and protection, is petroleum. Our striking force in the air, on the oceans, and over the land depends upon oil. The functioning of industry and the home fronts likewise depends upon an adequate supply of oil.

"The United Nations rely upon the United States for a major portion of their oil supply in all parts of the world. American refineries are the major source for 100-octane aviation gasoline, the greatest fighting fuel in the world, the source of extra power for planes, tanks, and certain types of specialized fighting boats. Oil from American fields powers British bombers over Europe, Navy fighters over the Solomons, Army planes in India, Soviet fighters from the Don to Lake Ladoga, General Sherman tanks in Africa, and American air forces in China.

"To produce and refine the necessary highly specialized war products, to transport them to all parts of the world, to supply the ingredients for explosives and synthetic products, and at the same time to maintain petroleum supplies for the wartime operation of industry and civilian functions, imposed a staggering burden upon the American oil industry."

Dramatic Achievements

Results of the effort to deal with these problems, after "taking council with the petroleum industry, in a year fraught with dramatic developments and technological revolutions," were enumerated by Ickes as follows:

1. Developed an industry-wide program embracing a technological revolution for the conversion of American refining capacity to the production of war products: 100-octane aviation gasoline, toluene, butadiene for rubber, synthetic alcohols, aviation lubricants and fuel oils . . . existing refineries were enabled to produce 2½ times the quantity of 100-octane aviation gasoline previously thought possible without new construction . . . New refinery capacity for 100-octane aviation gasoline was put under construction which will multiply production by many times . . . This indispensable fighting fuel was furnished in quantity to the United Nations . . . Instituted wartime revision of refinery operations to assure ample petroleum war products.

Material requirements for all new construction in petroleum refineries were determined, including 100-octane, toluene for TNT, butadiene for synthetic rubber, and aviation lubricants . . . Construction planned so plants might be built with greatest possible speed and without interfering with other necessary programs and with use of minimum amounts of scare materials.

Assured the availability of aviation and other high quality lubricating oils required in mechanized warfare by surveying national output of these products and, where shortages seemed imminent, arranging for operational changes or new construction.

Advised and cooperated in successful efforts to permit a complete cross-exchange of necessary technical information for processes to produce petroleum war products . . . Provided the factual information which forms the basis for the allocation of all aviation gasoline in continental United States and Aruba. The mechanism by which this gasoline is released to ultimate consumers also was provided.

Carried out the objectives of the Baruch rubber committee report by conducting and promoting developmental research in the production and manufacture of butadiene and other raw

[*Continued on page 38*]

Producing Enough May Be Additional Problem in 1943—Boyd

MOTORISTS "are getting only part of the gasoline they would normally use, home-owners with oil burners are on short rations, apartment houses and factories have had to convert from oil to coal—but 'not one ship or plane or tank has failed to move on schedule for lack of petroleum products,'" it was declared December 27 by William R. Boyd, Jr., chairman of PIWC, in a review of the year.

The quotation, he said, was taken from a statement by Brigadier General W. B. Pyron, liaison officer for petroleum of the services of supply.

"That is the job we set out to do, and so far the industry and the Petroleum Administrator, working together in what has become the most unique and what we think is the most effective industry-government team in Washington, have delivered the goods for the armed forces, where and when, and in the quantities, needed," Boyd continued.

"So far as its normal operations are concerned, the industry set few new records in 1942 to accomplish this, but it is a safe bet that no oil man with experience in the wildest boom times of the industry's pioneering ever went through anything like the nerve-wracking days of 1942, with a new crisis born every morning.

"Transportation, and men, materials, and money, were the oil industry's basic problems in 1942, and there is no question but that they will become more critical long before they are entirely solved.

"The East Coast has become the front porch of Africa and Europe, and large quantities of the petroleum which we have brought with so much sweat from the Southwest to the east have rested there only momentarily before taking off in army and navy tankships for the other side of the Atlantic. That is as it should be. If their hard pressed tankships do not have time to go all the way to the Gulf Coast for supplies, they can have every drop they need from the East Coast.

"The result, in decreased civilian rations, has been headline news all last month. The oil industry and the Petroleum Administrator have not yet given up hope, however, that further miracles will be brought to pass in tank car deliveries, to better the splendid job that already is being done, so that those who must have gasoline will get it, and those who cannot convert and must heat with oil will have enough to keep warm.

Manpower Shortage

"Materials and manpower shortages have been plaguing every operating branch of the industry and steadily are growing more acute. The oil industry recognizes fully that it is entitled to no more materials than are absolutely essential to perform the job the nation expects of it, but in some instances we have felt there has been a failure to understand these minimum needs.

"Daily we are losing skilled drillers, production men, and refinery experts

[*Continued on page 36*]

Hitler's Most Vulnerable Spot

By ROY E. LEIGH*

A FEW weeks ago, when Hitler still had the initiative, and when the approach of winter promised weather conditions favorable to military operations in the Near East, it appeared inevitable that Germany's next offensive might be directed against the oil fields of Iraq, Iran, and Bahrein. These prolific oil fields represent one of the greatest prizes of the war, the possession of which might spell victory for either side. At summer's end, the United States and Great Britain were fearfully vulnerable in that quarter, since these fields represent their only source of petroleum outside the United States and South America; and, in event of their loss, all naval fuel, bunker fuel, aviation gasoline, tank fuel, and all petroleum products required for mechanized warfare would have to be shipped across the Atlantic to England and Africa, and half around the world to India and Australia. The Near East represented our heel of Achilles.

Why, then, was the blow not struck?

Let us turn to a map showing Europe and Asia Minor.

Turkey Barrier

Neutral Turkey represents a barrier standing between the Axis and the oil fields of the Near East, the conquest of which might solve their greatest need: oil. Hitler has never been deterred by the rights of neutrals, so we must look elsewhere for an explanation of his failure to strike a blow which might win victory for him, or wreak disaster upon his enemies.

It appears that, for the present, Hitler would rather hide behind the Turkish barrier than to transgress it, as it affords more protection to him than to the Allies. Turkey fends the Germans off from one of the Allies' most important sources of petroleum; but Turkish neutrality also affords a shield of protection for Hitler's only important oil fields, in Roumania. The failure of a campaign across Turkey or its adjacent waters would be fatal to the Axis cause; whereas German successes in this direction might only be crippling to the Allies, to whom the sea lanes are still open for the shipment of American oils.

Exploits Roumanian Oil

News has trickled out of Europe regarding German exploitation of Roumanian oil fields. All these reports, which deal with the construction of pipe lines, railway lines, tanker routes, and barge lines, can be supported by the laws of probability. Hitler needed such facilities. He had the opportunity; so he must have built them. Without them, his mechanized warfare could not have been supported thus far.

Roumania, more than any other oil-producing country in the world, was a melting pot for the exchange of ideas between petroleum engineers of varied nationalities, Americans, English, Dutch, French, Roumanian, German, and Polish. After the internment of such American and British experts as may have remained at their posts in Roumania when that country was over-run, there was left a cadre of Roumanian, French, German, and other European engineers and technicians possessing the skill and experience necessary for the continued operation of the Roumanian oil industry in all its branches, including production and refining. The evidence supports the conclusion that production was maintained by such men and their methods, although we are willing to wager that they suffered somewhat from the restrictions of the bottle-neck pertaining to rotary drilling.

Reports reaching this country from neutral sources in Europe state that the Germans have looped the pipe line running southward from Ploesti, the principal oil-producing center, to Giurgiu, an oil port on the lower bend of the Danube, where petroleum and its products are pumped aboard small tankers and barges plying this important waterway. Cargo-loading facilities at New Moldavia and Harsova have been enlarged and expanded. These are alternate river ports down-stream from Giurgiu, which are served by pipe lines from the oil fields around Ploesti. To facilitate this water-borne movement, the old Danube has had her face lifted by extensive operations of deepening and widening; and several hundred new river tankers and barges have been assigned to the shipment of oil along the river routes from Eastern Europe to German industrial and military centers.

In addition to the looping of various pipe lines, the mountain division of the railway from Ploesti to Brasov has been doubled; and a new railway line has been constructed across the Province of Transylvania.

Fear Oil Bombing

Hitler refrained from violating Turkish neutrality, fearing that a belligerent Turkey might admit Allied warplanes to the use of air fields, some of which lie within easy bombing range of Roumanian refineries, pipe-line pump stations, cargo-loading facilities, tanker routes, and barge lines. This would put the Allies within easy reach of several vulnerable links in Hitler's chain of supply.

A tight little circle, having a radius of only 100 miles, with its center approximately half way between Constanta and Ploesti, embraces the pulsating heart of Roumania's oil industry, including production, storage, refineries, pump stations, port facilities, and railways carrying tank-car movements, as well as river transport and tanker trade across the Black Sea to conquered regions in Russia. No doubt, the German offensive of 1942 was fueled in part by tankers loaded at Constanta and routed across the Black Sea to Russian ports in German hands. A few "block-buster" bombs dropped on oil installations at Constanta, Giurgiu, Harsova, New Moldavia, Ploesti and vicinity might hit Hitler in his most vulnerable spot.

This, then, is the probable basis for Hitler's respect for Turkish neutrality.

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* Formerly Foreign Editor of The Oil Weekly, now head of Leigh Oil Company at Austin, Texas. He sees the war from the oil angle. "Stop Hitler's oil," says he, "and his planes won't fly, his tanks won't run. Break one link in his chain of supply—production, refining, or transportation—and his Wehrmacht will come to a halt."

Unsatisfactory Exploration Status Demands Attention

By E. DE GOLYER
Assistant Deputy Administrator, Petroleum Administration for War

WHAT is the present status of exploration—of the wildcatting effort—in the oil industry and particularly in the Mid-Continent and the Gulf Coast regions?

Our exploratory effort in the United States, as measured by the number of wildcat wells drilled or by the number of geophysical crews and core drill crews in operation, and these are excellent indices, is at an all-time peak. Slightly more than 3000 wildcat wells were completed in 1941 and approximately the same number will be drilled this year. An average of some 222 seismic crews and 29 core drill crews were in operation for the first ten months of the present year, a greater number than at any previous time for which statistics are available.

Intelligently directed exploratory effort is at as high a rate as it has been at any time in the past. The results of such effort, however, are inadequate. They are below our hope and expectation. They are below our necessities. We are coming to the close of the fourth year when our new discoveries appear to have been at the rate of approximately five to six hundred million barrels per year against consumption of substantially more than one billion barrels per year. Obviously, we have been losing proved reserves on balance.

Our proved reserves — something of the order of magnitude of 20 billion barrels—would be great enough for the war program if they could be recovered at the required rate and if their locations made them readily available. However, we know this is not so. We have been losing to a marked degree our ability to produce daily and such excess productive capacity as remains to us is, in large part, located where transportation facilities are not sufficient to make it immediately available. Excess productive capacity in the Gulf Coast or the Permian Basin of West Texas and New Mexico will not compensate during the war period for deficiencies in meeting the requirements of the New England and Atlantic States, nor of California.

An address delivered before the quarterly meeting of the Interstate Oil Compact Commission on December 18, at Oklahoma City.

Lack of Big Fields

What is the cause for the unsatisfactory conditions as to the results of exploration? In my opinion, it lies in our failure to discover large fields at a rate as great as we have discovered them in the past. From 1934 to 1938, inclusive, we found 121 new fields and an average reserve of 1.8 billion barrels of oil annually. The average estimated new oil discovered per field was slightly in excess of 15 million barrels. This average was high because each year's crop contained several fields with reserves of 100 to 200 million barrels or even more. For the years, 1939 to 1941, inclusive, the average number of fields discovered annually was 242, exactly double the average in field units of that for the preceding five years. Because of the lack of finding big fields, however, the estimated reserve per field has dropped to less than 3 million barrels and, as I have previously noted, the total new reserve discovered to an annual average of some five hundred to six hundred million barrels. Over the entire eight years, the number of fields discovered in each year has been greater than that discovered in the preceding year but the average reserve has dropped from almost 20 million barrels per field in 1934 to less than 3 million barrels per field in 1941. There is no apparent marked change in this trend for 1942.

The results of recent geophysical activity and core drilling upon which much of the wildcat drilling of tomorrow must depend, are not susceptible of quantitative analysis at present. I am advised, however, that the first-class prospects of the recent search, are comparable with the second and third-class prospects of a few years back, and, on such basis, the outlook for discovery in the immediate future is not encouraging. Thus our low rate of discovery seems not to be a result of slackening of effort so much as due to the lower quality of prospects, which indicates an exhaustion of prospects discoverable by the present methods of utilizing known techniques.

For the purpose of our present consideration one might classify all types of oil deposits which occur in underground traps as consisting of traps formed by updip wedging out of porous beds or traps formed by folding or faulting, or both.

These are, respectively, the so-called stratigraphic and structural types of occurrences and, with the exception of a few relatively unimportant pools, all sub-surface oil occurrences can be referred to one or the other of these types.

Change in Search Needed

It is in a search for the structural type of occurrence that the industry has, up to the present time, concentrated practically all of its scientific and technical skill. Geologists have searched for anticlines and domes; geophysicists have sought the same types of occurrences in areas where the geologists had not been able to find them. The structures now being found in known petroliferous provinces and which must be in the main prospects for structural wildcat drilling within the next year or two are very small if the reports which we receive are correct. The point I wish to emphasize is that we appear to be about out of structural prospects. This suggests that we must depend increasingly upon the discovery of the stratigraphic trap type of occurrence at least until we emerge from the present doldrums of exploration in our known petroleum provinces or until a new prolific area is opened. Statigraphic fields thus far discovered include such areas as East Texas, Burbank, Hull-Silk, Kern River, and Kern Front, and the Shoestring pools of Kansas.

From the viewpoint of the prospector, I should say that the distinguishing thing about the stratigraphic trap type of occurrence is that it has required much greater amounts of drilling for

discovery than has the structural type. The problem of exploration is not nearly so well localized in drilling stratigraphic traps as it is in drilling structural traps. A well drilled on a structural trap should determine the possibility of finding oil to the depth drilled in 80 or 90 percent of all possibilities whereas it is entirely possible that 8 to 10 dry holes might be drilled on a vaguely outlined stratigraphic prospect before the location for a definitive well could be determined.

New oil fields must be found to insure a continued supply of petroleum products. There must be wildcatting and exploration to open new pools, the majority of which probably will be of the stratigraphic type. This means many dry holes even if the best finding techniques are employed because no methods have been developed which can determine directly the occurrence of oil. Oil is where you find it.

The problem of finding new reserves cannot be solved by application of any single method. Every known method must be utilized. New uses of present techniques must be developed and even random drilling must be employed more and more. Existing data, geological and geophysical, must be restudied and reappraised in the light of our most advanced knowledge of oil occurrence and we must be prepared to take longer chances in wildcatting than has been the custom during the past ten years.

Prospecting for oil and gas is only a single phase of the much older business of mining and while as long as four centuries ago an Italian expert wisely resolved this matter of random versus rational exploration with his conclusion: "Nor must you believe what many say, that you will find such things by digging at random, for although this might happen you must place more faith in art and good practice than in chance." We know in the oil business that we owe a great part of our proved reserves to random drilling and that it is our ultimate recourse when the rational techniques are exhausted. At present, in our major producing areas and with our available finding tools, the stratigraphic trap type occurrence offers the greatest promise of increasing our oil reserves.

Subsurface experts, by comprehensive studies of regional geology and lithology, should be able to outline areas in which oil pools may exist even though it will not be possible for them to indicate the exact location for successful wildcat wells. Further improvements and developments in present techniques and the geologic data to be contributed by many dry holes should eventually lead to comparatively precise methods for checking areas of promise and determining to some degree where the permeable strata exists under the requisite trap conditions—conditions which are not determinable from the surface. Slim hole drilling should contribute information from which subsurface maps may be prepared and eventually oil pools located.

In order to find structural prospects, we must explore with our proven techniques and tools those areas not yet detailed but where geological factors appear favorable to the accumulation of oil. I am sure that we all know that there are some areas in such oil producing states as Texas, Louisiana, Arkansas and Kansas, to mention a few, which have not been covered by detailed surveys of the highest type of resolving power. Also, there are much larger areas in non-oil producing states or in states producing comparatively small amounts of oil such as Montana, Nebraska, North and South Dakota, Florida, and in other regions, which, from geologic considerations, could become oil productive. Reasons for the lack of determined effort in these areas is, first, the fact that intensive explorations usually has been concentrated along proven productive trends, and, second, high costs. However, these areas must be investigated since, today, they offer the most fertile ground for our proven exploratory tools, and are among our best prospects, until a new method of exploration is developed, of finding additional oil and gas pools.

Careful planning and procedure will result in concentrating our wildcat efforts in those areas where success is most likely to be achieved and, if diligently carried out, should result in increasing our oil reserves and our ability to produce more oil currently.

These types of exploration programs —that is an intensive search for stratigraphic traps and such additional structural prospects as remain, both along productive trends and in comparatively new areas—will require infinitely more technical work, more wildcat wells, more dry holes per oil pool found, and, inevitably, a higher finding cost at least until more certain methods and techniques of finding are developed than are now available to the industry.

Costs to Be Higher

In my opinion the finding cost entailed in the extensive exploration for stratigraphic traps and for additional structural accumulations is known or new areas could easily be at least twice as high as the present finding costs of some successful companies which range from approximately 20 to as high as 35c per barrel. In contemplating these latter figures, it should be borne in mind that these costs are for successful companies and do not take into account the large amounts of "venture" money invested in the oil business that will never pay any return and in many cases is lost entirely.

If the estimated costs of finding additional oil reserves should become as high as 40c to 70c per barrel, it will readily be seen that to increase our oil finding and oil reserves, it is likely that we will return again to the cooperative type of venture which were so common in the Mid-Continent in the twenties.

It would appear to me that a return to the old type operation is indicated. By this I mean the development of a prospect to a stage where a test well is desirable, followed by the selling of spreads of leaseholds or percentages to various other interests. This will reduce the risks and costs of individual companies or operators. Likewise, in my opinion, there exist today areas that are good prospects for exploration but in which the actual drilling of wildcats is being delayed because of checkerboarded lease ownerships and inability or reluctance of the operators to get together on any planned cooperational operation.

It has now been approximately thirteen years since a new method of locating oil prospects has proven its worth. Since there is no new method on the horizon which has yet presented evidence of revolutionizing the search for oil, it is up to the industry-geologists, engineers, geophysicists, yes, executives, as well as all persons connected with oil, including the state regulatory bodies and the Interstate Oil Compact Commission, to help adjust and improve all methods now in existence and to minimize the higher costs that are bound to attend the intensive search that must be undertaken for new reserves.

Conclusions

Summing up, it appears to me that at least four attacks on the problem are advisable; first, the development, through research, of new technique capable of finding structures which have not been discovered by methods now available; second, integration and refinement of the most effective methods now in use in order to increase success in locating stratigraphic traps; third, intensive use of all presently known methods, as well as those which may be developed in the future, in areas not now productive of oil but geologically favorable for its presence; and fourth, a cooperative and determined effort of all concerned to subordinate, for the duration, all private interests in order that the nation's oil reserves may be increased to such an extent that there will be no possibility of an oil shortage to plague us during this emergency.

Concrete Blocks Replace Steel For Pumping Counterweights

By ELTON STERRETT, Staff Writer

THE production division of the oil industry has long used iron and steel scrap for its weight value in pumping-unit counterweights, equalizing boxes for distributing torque on back-crank pumping units, and for reducing the necessary inequalities in central-power-load distribution occasioned by lease shape and drilling patterns.

In the days when it cost several times the potential scrap value of the material thus used to haul it to the nearest disposal point, elaborate platforms were sometimes built to hold the scrap, tank steel boxes were attached to pumping beams to allow any desired amount of extra weight to be added as well characteristics changed, and no effort was made to restrict the counterbalances to metal of low or no scrap value. In consequence, many weight boxes contained alloy steel, such as worn out drilling bits, bearings, and short pieces of drilling chain, in addition to broken valve bodies, flanges and other parts chosen as much for their ready portability as for their weight.

Wartime scrap demand to keep the steel furnaces operating changed the picture as far as counterweights were concerned. Many critics of the oil industry arose to suggest immediate and sweeping condemnation of all counterweights, irrespective of size, material, or possibility of economic and practical replacement with other materials. Astronomic figures were (mis)quoted to show that collection of these weights alone would all but end the steel shortage, with no mention of the fact that such a procedure would also all but end production of needed oil in all pumping fields.

Long before the war need began to bring home the material waste in using scrap metals for counterbalancing pumping units, many producing companies had begun to experiment with concrete as weight material, in some instances using this material to the total exclusion of iron or steel.

Types of Pumping Units

As far as counterbalancing is concerned, pumping units fall into two classes: those in which the counterweights are attached to the driving mechanism and rotate with some portion of it; and those in which the weight is riding the beam. The first class, using weights which rotate, usually involves several factors such as limited clearances, close regulation of revolving mass by addition (or subtraction) of known increment units, and the necessity of attaching the weights through ears, lugs or other fastenings to overcome the varying work cycle in which tension and compression in the fastenings alternate depending upon the relative positions of shaft and weight.

In this first class the counterweights usually are designed, specified and furnished by the pumping-unit manufacturer, and must be used exactly as computed unless excessive unbalanced forces are to be set up within the drive mechanism and early failure or excessive maintenance ensue. Likewise, these counterweights usually are cast from the poorest grade of foundry iron, high in phosphorus and other impurities, and not only unsuitable for steel making but also valueless for machine or other castings where stresses are involved in the design. Such castings then are a by-product of other foundry operations, and represent utilization of what otherwise would be waste metal. Thus there is neither economic nor metal gain in replacing rotating counterweights already in the field with substitutes; nor even in the redesign of such units as now have rotating weights to involve the use of reciprocating or rising and falling balances.

Certain of the riding counterweights also are made from the poorest grades of cast iron, and probably would justify replacement only if used in the foundry to cast rotating weights to be used to replace steel plate or high-grade castings already in use. No direct war use or gain in munitions or war products could be obtained by scrapping, collecting and replacing these.

But many riding weights, as furnished by the manufacturer or formed by the company welder in the field, are made from high-grade castings, or are cut from steel plate. These are valuable in steel-making, and are being replaced where possible by concrete.

Also, contents of weight boxes, and even the steel of the boxes themselves, are of high reclaim value in steel-making, and justify considerable effort and expense in their replacement.

Types of Weights

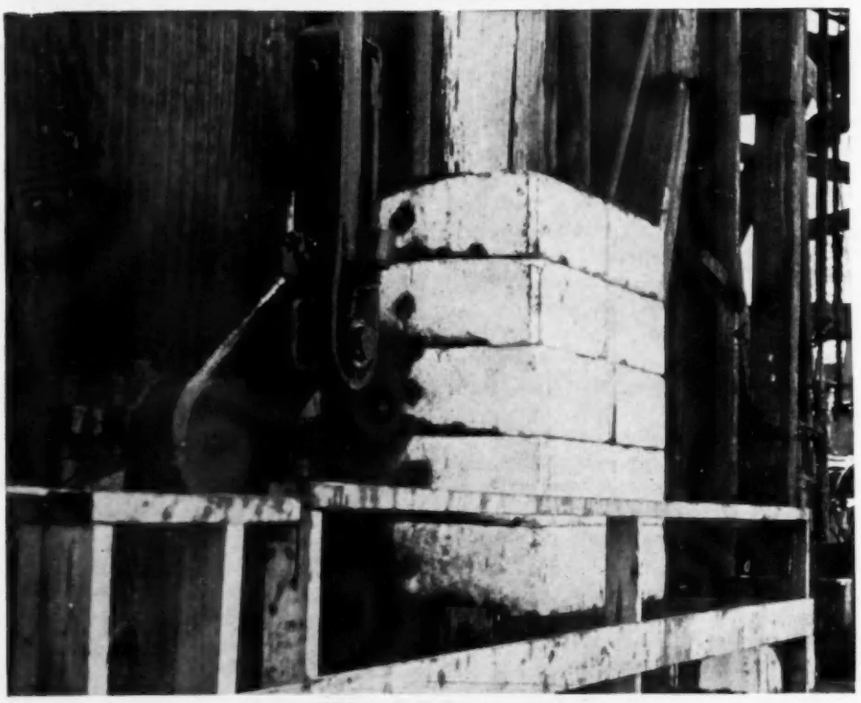
To allow for the increase in bulk required for replacing steel (or iron) counterweights of the riding type by concrete, it is necessary to allow for the fact that concrete weights around 150 pounds per square foot, as compared with 450 for cast iron, and thus three cubic feet or more of clearance space must be allowed for one taken up by the iron counterbalance.

This question of clearance has led to the use of hanging or swinging weights on many pumping units where the ground clearance permits such a plan. The concrete is cast into a rectangular block, or sometimes is simply shoveled into an oil drum, the desired stirrup or supporting bolts placed before the concrete hardens, and the finished weight slung from a chain, hook, link or other flexible attachment at the end of the beam.

Unless provision is made to guide this counterweight in a vertical plane during the working cycle, it frequently develops an oscillating action which imposes severe and often wrecking force on the pumping unit. Methods for curbing this side sway range from casting pipe guides in the weight, and the installation of properly placed slides for these to work over, to the provision of trunnion bearings at some point near the center of mass of the weight, and the use of spacer bars to give the weight a prescribed vertical path of motion.

On long-stroke pumping units, where the earlier weight operated in a cage between pitman and belt house, there is usually space on the length of the supporting rod to increase the height of the weight the three times necessary to accommodate the greater bulk of the concrete, and no structural change is necessary.

Suspended weights such as these are adjustable only through the addition of auxiliary weights, attached to or riding on the initial units. This plan of com-



pensating for changing well characteristics is rarely satisfactory, due to clearance limitations and the difficulty of attaching such rider weights firmly enough to withstand the vibration and loosening effect of the reversals occurring during the pumping cycle.

Since the beam of the usual conventional type of pumping unit may be either of two types, the design of the concrete counterweight also must conform to one of two types.

Where a single heavy I-beam or two channels bolted, riveted or welded back-to-back forms the oscillating member of the pumping unit, the supporting surface on the top of the beam is relatively restricted, and considerable overhang of the weight and consequent possible wobbling and loosening of the fastenings might occur.

One operator circumvents this difficulty by pouring the weight in two pieces, with short pipe nipples cast into each to provide necessary holes for the attaching bolts. These blocks are made in rights and lefts with the inside of the form in which the block is cast being tapered to conform to the angular slope of the flanges of the beam into which the unit is to fit. These blocks are also fitted, at time of being cast, with eye-bolt or loop of sand line, so as to aid in handling with the usual winch truck.

Such paired blocks are located alongside the channel beam, the formed sections wedging tightly within the sides of the beam, and being supported by this wedging action, rather than by stresses borne by the three or more attaching bolts which pass through both blocks and the intervening web of the beam.

One operator using such a counterweight system improves the contact between concrete block and beam flange by placing a narrow strip of tar paper as spacer between concrete and steel. As the weights are drawn tight into the web

Top—Dual blocks, formed to fit snugly within the tapered sides of the I-beam, bolt firmly in place and add no complications in such an installation, where ample clearance is available and where the load to be carried is light. Such a balancing plan, however, requires complete replacement as conditions down the hole change.

Center—On a long-stroke unit, where the original weights ride a rod within a guard, a substitution of concrete—cast in several pieces to aid handling—does little save ride higher on the carrier structure. The changes in pumping load may easily be controlled by adding sections of varying thicknesses to cover desired weight increments.

Bottom—Only the pipe at the bottom and the two weight-supporting arms of channel remain of the former all-steel weight-box unit used here to balance a power drive hook-up. The concrete is cast in blocks of about 50 pounds weight each, and are simply piled on the platform to give the desired loading. Under vibrationless operation no tie-down is required.

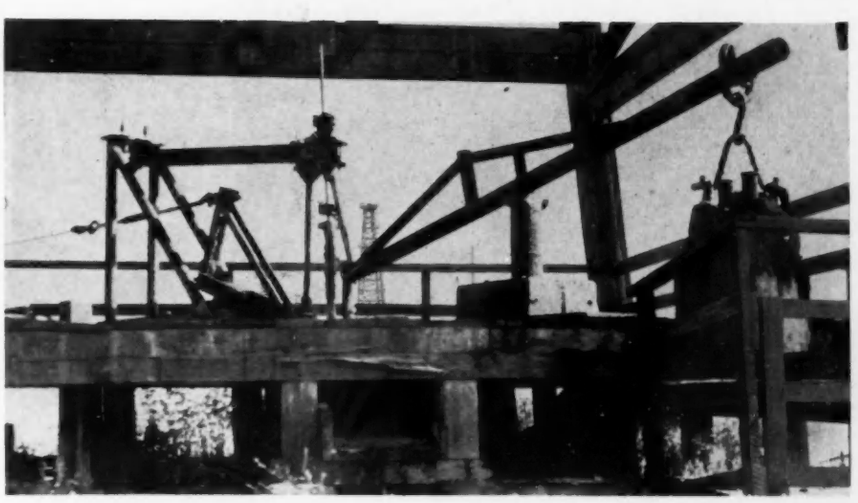
by action of the bolts, such a cushion or pad conforms to the irregularities of the block, affording much firmer support than might be obtained were direct contact obtained only at a few high points.

By spacing the bolt-hole nipples accurately in the molds when the blocks are cast, and laying out a series of corresponding holes the length of the web of the beam, it is possible to shift the weights the distance between bolt holes as partial compensation for change in well characteristics as the fluid level drops and pumping load increases. The practical limit on such a method of adjustment lies in the possibility that too many bolt holes through the web of the beam will weaken it and introduce flexibility which, in turn, quickly causes breakdown or at least loosening of the attaching bolts.

Where the pumping unit beam is made up of two channels or I-beams with spacers between, the limit on the possible supporting surface for counterweights is then imposed by the practical length of the saddle bearing at the beam center, and the designer is afforded greater latitude in working out the type of weight block to be used.

Overhang of the weight must be restricted, or the unsupported section, under the influence of any side-sway in the unit, may develop a periodic oscillation across its support which will overstress the hold-down bolts and overload the saddle bearing on each side of the beam alternately top and bottom. Or, if the bearing be sufficiently sturdy to withstand the side strain, the bolts may snap, dropping the weight onto the supporting structure and wrecking the entire unit.

The effective counterbalance effect of the weight may be considered as exerted at the center of the mass, and thus excessive extension of the long concrete block toward the beam bearing, while



Top—An oil drum serves equally well as form for pouring this counterweight, and as surface to carry out the painting scheme. The weight is provided with side arms to check end sway and the gradual building up of an oscillatory force which would pull over or wreck the pumping unit, or cause failure of the saddle bearing or pin member.

Center—A pre-cast concrete block, equipped with suspension loop and cross member for restraining arms. Both this unit and the one above would operate more smoothly if the distance rods used were pivoted directly below the saddle, and were of the same length as the distance from hook to beam bearing, as exact parallelism of forces would then occur.

Bottom—A pumping jack is here counterbalanced through the installation of a counter beam, on the end of which is hung the caged concrete counterweight. Frequently a sheave carried in the derrick serves to allow the counterweight to act as in this installation, to lift the jack instead of to exert its force downward, as in normal walking beam installations.

adding to the static load which the beam must support, contributes but little to the effective weight available for balancing the sucker-rod string.

Many operators find that the provision of a thin cushion between counterweight and top of beam extends the life of hold-down bolts and prevents breakage of the concrete unit through excessive tightening of the bolts in the effort to forestall working and eventual shift of the weight. For this cushion a strip of tar paper laid along the beam before the concrete block is placed is good, although in hot or dry conditions the material may soften under heat or fritter away and thus become lost—introducing slack in the bolts and resulting in damage unless the condition be noted and promptly corrected.

Plies stripped from old, discarded flat belting, either balata or leather, are also frequently used, although if either type is more than 1/16-inch in thickness, the cushioning effect may also permit slight endwise compression, allowing the weight to work along the beam with each reversal of inclination of the long axis of the block.

True riding weights, as contrasted to those slung below the beam, must be firmly anchored to the beam to prevent longitudinal shifting, angles being welded across the beams at the ends of the block, or the hold-down bolts being let through sockets, niches or recesses in the beam structure. An alternative fastening method involves the casting of pipe nipples in the block, these being spaced to slip down over bolts welded to the compound beam structure, and to carry washers and tightening nuts at the threaded ends. This method is open to the objection that, unless the maintenance crew is especially careful when placing the weight, the exposed thread ends may be damaged, or, if protected during this operation, may be stripped by pulling too strongly on the nuts when fastening the block in place. In either case, the damaged bolt must be cut from the structure and a new one welded in place before the work can continue.

As with other types of counterweight systems, the riding weight usually is not adjustable to varying well conditions. It must be computed as closely as possible to fill existing, and known, requirements, and must be supplanted by another unit when the well load changes in excess of the desired spread between rod and counterbalance tonnages.

Adjustable Hold-Down Method

An ingenious type of riding weight and adjustable type of hold-down which was first developed to permit the operators of an east edge pumping lease in the East Texas field to compensate for frequent changes in pumping characteristics of their wells overcomes many of the objections to the use of a concrete block as counterweight.

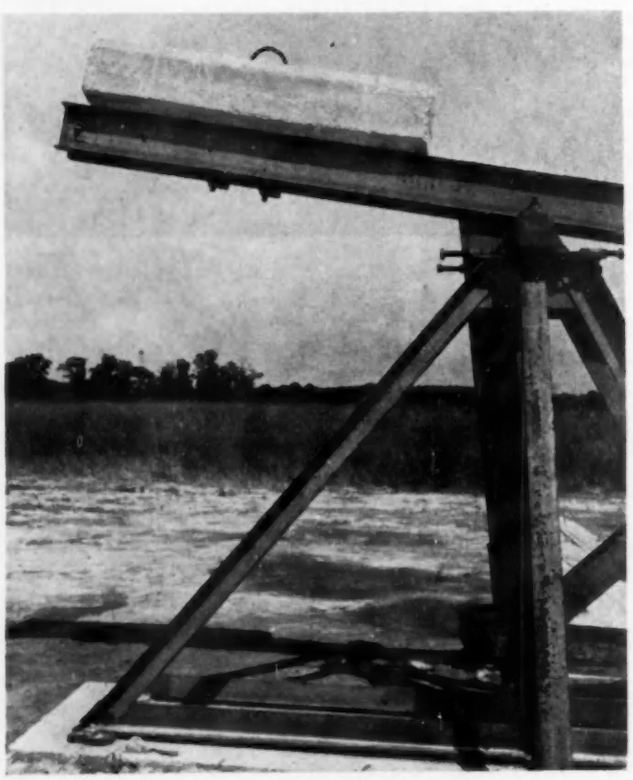
For the wells on which the plan was developed, the walking beam used was of the compound type, with two parallel I-beams separated by six-inch cast-iron spacers. Overhang of the beam from the saddle bearing or point of support was 6 feet, a cast concrete weight being originally slung from a hook welded to the end of the unit.

On the work-over to permit use of the adjustable riding weight, the parallel beams were spaced by replacing the cast-iron center block with a welded unit in which were two 1¼-inch pipe nipples, extending flush with upper and lower surfaces of the beam. These were spaced with their centers 3 inches either side of the center of the beam length.

The concrete slab-type counterweight was made 4 feet in length, 12 inches wide, and 9 inches thick, giving an effective weight of 3 cubic feet of concrete, or (as weighed) 450 pounds, considered to be effective at the center, or 2 feet from either end of the block as mounted.

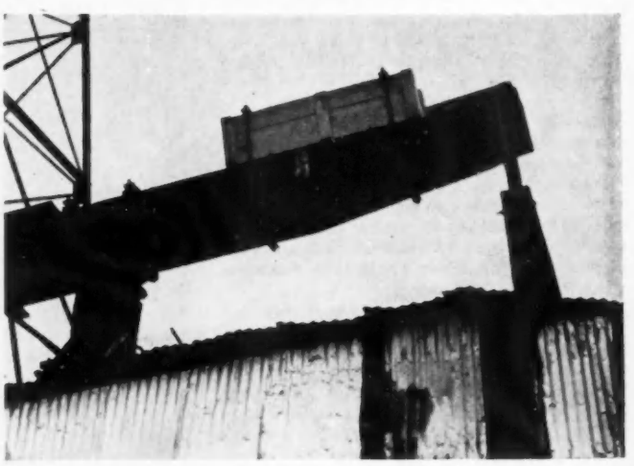
In each block, as cast, were also incorporated two 1¼-inch pipe nipples, 9 inches in length. Considerable care was exercised to see that these two nipples were set parallel and properly, one being set 2 inches (on centers) from the short axis of the block, the other 6 inches on the opposite side of the axis. These two bolts have been designated "B" and "A," respectively, on the accompanying explanatory sketch. The two bolts then are 8 inches apart on centers, while the corresponding bolt holes or welded sockets in the compound beam are only 6 inches apart. Thus only one bolt can be passed through a socket, the other lying within the annular space separating the twin beams.

By designating the two bolt holes in the beam as "1" and "2," respectively, as met progressively outwardly along



Left—This type counterweight, a slab of the riding type, may be equipped with offset bolt holes and the two sockets in the beam set to provide a differential adjustment of weight and beam, permitting as many as eight shifts of the one weight unit to accommodate as many variations in well pumping characteristics.

Below—Here a form was fastened at the desired point on the wooden walking beam with a pair of heavy U-bolts, and the box filled with the required amount of concrete. The use of the box as anchor for the weight is apt to prove troublesome as the wood swells or shrinks under weather changes, and as deterioration sets in. Better practice is to bolt weight directly to beam.



the beam, it is possible to move or reverse the one weight and to obtain eight different settings or effective counterbalance positions, with but one concrete block. If the weight be designed originally to meet conditions as at present existing when set in the position nearest the saddle bearing, it is then possible, simply by shifting the block and while always keeping one bolt aligned with corresponding socket in the beam, to increase the counterbalance effect by (in the case and with the dimensions shown) as much as 67 percent, in increments which fall well within the tolerances of the beam and pumping-unit specifications.

To show further the possibilities, it is assumed that the block be first placed so that block opening "A" be aligned with hole "1," and with opening "B" toward the saddle. This is marked on the sketch, for clarity, as being "A_R," and gives minimum weighting. Next in effect would be the alignment of hole "B" with position "1," with the block as shown in outline below the schematic beam.

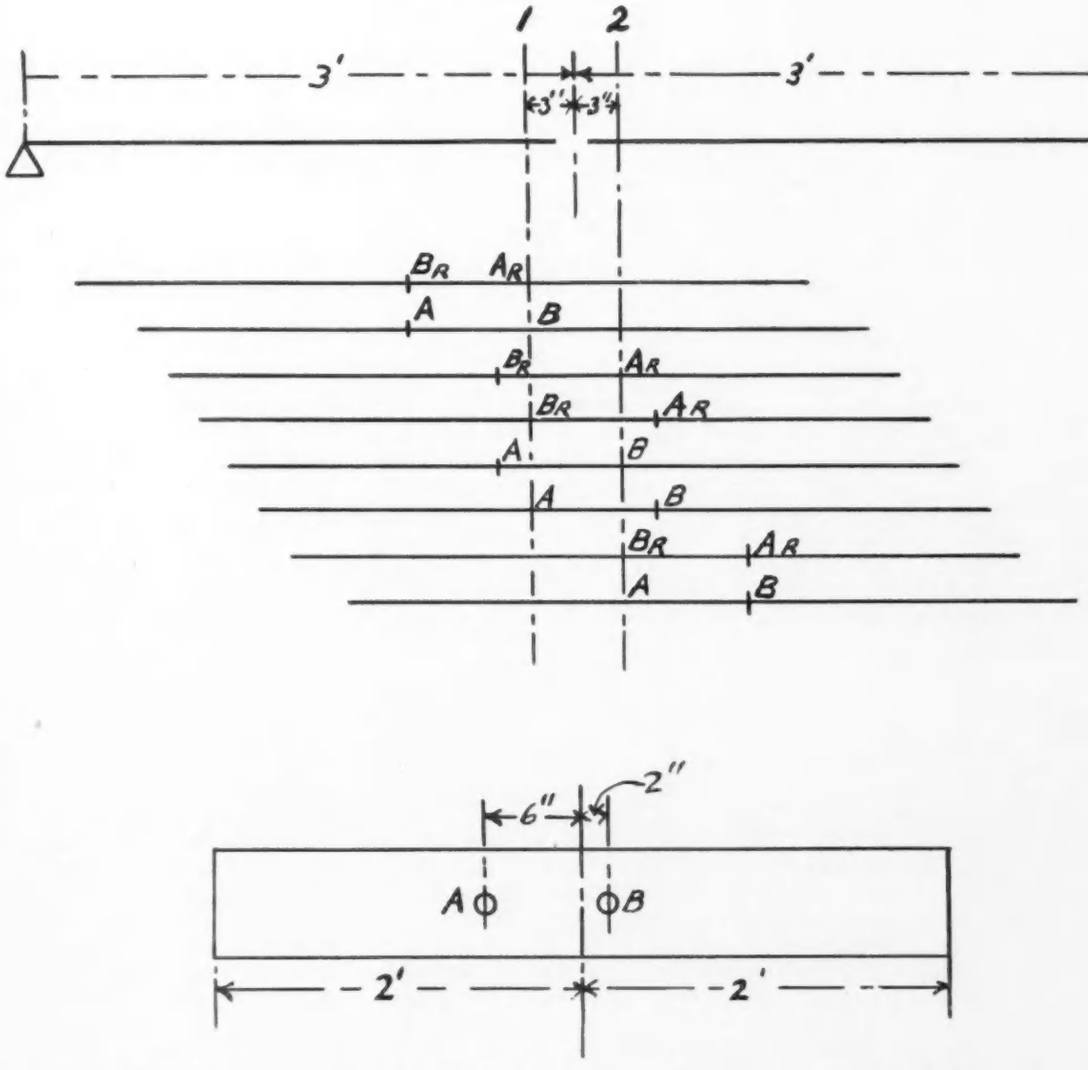
Progressively shifting the weight to bring the various alignments as shown, maximum possible loading is obtained by aligning hole "A" with position "2."

Casting a lifting and balancing loop at the short axis of the block simplifies the lifting and placing of the unit, and enables the reversals necessary for graduated adjustment to be made with a minimum of labor and loss of time.

For holding the weight in place, two special 1¼-inch bolts, with wide T-shaped heads, were used. The washer at the bottom was a strap, wide enough to span the twin beams, and with ¼-inch upturned lips or ears to hook over the flanges and center the hole directly under the concrete block aperture. Thus, although only one bolt was rigidly restrained against longitudinal shifting by the welded-in socket, the other bolt was made effective in aiding to curb flopping or vibration of the weight. An improvement, worked out later, involved use of a single tie plate instead of the two straps, one piece carrying the two bolt holes exactly as spaced in the concrete block, and thus affording additional stiffness to the base of whichever bolt was not supported throughout its length in block and socket. Adoption of the plate practically eliminated breakage of the rigidly supported bolt.

Power Units

Replacement of the pump castings, engine cylinder heads and other miscellaneous machine parts frequently found on power equalizer units with concrete blocks makes available per unit from one quarter to as much as a ton of



Sketch showing differential spacing of beam and block bolt holes to permit eight settings of counterweight. Drawn approximately to scale.

usable and badly needed steel-making scrap. In many instances it is necessary only to enlarge the box in which the loose scrap has been held, filling it to the desired height with concrete, and leaving the supporting structure unchanged. In other cases, where the weight box has been set relatively close to the pivot bearing, it is necessary only to extend the base, as the additional leverage gained by moving the center of mass outwardly to accommodate the increased volume of the concrete unit compensates for the replacement in weighting materials.

Where considerable bulk is added, and a yoke and single bearing have sufficed to carry the iron-filled counterweight box and operating arm, it is desirable that the pivot be revised to afford considerably more side support. Where possible, an additional bearing is used and the foundation widened to bring both supporting points outside the overall width of the block. Incidentally, such a mounting is found in many instances to extend the life of the pull rod tying the counterbalance to the power system; binding, cramping and side-loading being reduced and the alternation in stress reached more gradually and uniformly.

Waterproofing

Just as the operators found that the weight box, whether filled with scrap metal, rock, sand or gravel, required adequate drainage provisions to prevent the effective loading from being materially changed by prolonged rainy spells; so have they learned that the concrete block is much like a sponge in its tendency to absorb water and then to evaporate it. Concrete will take up as much as 30 pounds of water per cubic foot, depending upon porosity of the aggregate used, size of sand grain, and richness of mix. Thus the effective weight of a 3 cubic-foot block may be increased by 90 pounds, or 20 percent, during a long rainy period. Again, if a rain-soaked block be shifted to give proper balance, that same concrete, following a long dry spell, may fall under weight enough to throw the well system so far off balance as to introduce damaging stresses.

Also, in climates where severe winter weather may be expected, concrete which has become watersoaked may freeze and spall off during cold weather, this spalling continuing with each alternation of wet and cold until the block may lose an appreciable amount of its initial bulk, and the balance thus be reduced below the practical minimum.

Several methods of waterproofing the counterbalance block have been tried, and found effective under certain types of operating conditions. One rather messy but practical method consists in setting the concrete block in the slush or waste pit, allowing it to become soaked with waste oil and the pores thus filled or sealed off to prevent entry of water. This type of block is unsightly, tends to exude oil during warm weather, and if of the beam-riding type, may introduce handling hazards.

Another waterproofing method requires the formation of a fairly smooth surface through troweling or grouting the concrete after casting, and the application of primer and finishing coats of a good cement paint. A block thus finished may be repainted as often as the surface shows flaws or discolorations which indicate the penetration of water beneath the protective film.

One company dips its counterweight blocks in a bath of hard-blown asphalt, after drying the piece thoroughly to expel as much moisture as possible. If this precaution is not taken, contained moisture may form steam within the block when the unit is dipped in the sealing bath, resulting in an explosion or at least cracking of the block. Hot pipe-coating materials, especially those with a melting point around 450° F., may be sprayed or brushed on a dry block, forming a coating which remains tight over extended periods, but which is brittle and thus liable to fracture if handled roughly when the block is being transported or placed on the beam.

Another company, operating in cold climates, coats the blocks during the hottest part of the summer with molten paraffin. The blocks are dried for at least a week by placing them on a rack over drilling or treating-unit boilers, with proper shelter against occasional showers. Then, while still hot, the blocks are painted with the paraffin which, already thinned by melting, is kept in the molten state and allowed to penetrate and seal the block's pores until the entire unit temperature has gradually dropped below the solidification temperature of the paraffin used.

Experimental applications of liquid wax, in which the solidification depends upon the evaporation of a solvent to produce the sealing coat, does not seem to work out satisfactorily on the concrete, the solvent tending to be absorbed by the dry concrete, and then to work out again as osmotic changes occur within the unit, sometimes resulting in the loosening of flakes, other times of entire sections sections of the coating, with consequent exposure of the raw concrete to water absorption.

Housing the weight block with a corrugated iron cover which fits closely down around the block is effective against all save water taken in through the bottom of the block, but is apt to become noisy with service and, if any motion between block and cover occurs, to result in eventual abrasion of the thin metal and exposure of the block to the weather.

Addition of various waterproofing compounds, such as the well-known lye and alum mixture, in which one pound of commercial lye and 5 pounds of alum are dissolved in 10 quarts of water and ½ pint of the solution added to each 2½ gallons of water used in the mix, are sometimes used. This solution is hard on the hands, and must be added when the blocks are cast, restricting the entire batch to objects which are desired waterproofed.

Perhaps the most effective all-around sealer for cement weight blocks is one of the aquarium cements, which may be mixed when needed and applied over dried blocks. One such cement is compounded in the proportions of 10 pounds of glazier's putty, 1 pound litharge, 1 pound red lead, 4 fluid ounces of asphaltum—all mixed with sufficient boiled linseed oil to give the desired fluidity. This mixture may be tinted with carbon black if the natural color of concrete is to be maintained after waterproofing the block. Other mineral colors may be used in place of carbon black if a color scheme is to be followed.

Another effective sealer is made up in the proportions of 3 parts of red lead, 7 of litharge, 10 of fine sand and 1 part powdered rosin, spar varnish being used to thin this to obtain the desired consistency. In preparing either of these sealers, care must be exercised to see that air bubbles are not incorporated in the mixture while stirring, and that the application is such that as little air as possible be trapped beneath the sealer as it is brushed onto the concrete.

Where wooden walking beams or heavy plank platforms are relied upon for support of the concrete block, especial care must be taken to see that not only is the block sealed against the absorption of water, but that the wood below is also effectively proofed. The contact of raw concrete and unprotected wood offers a combination which greatly accelerates wood disintegration and resultant loosening of the fastenings holding the block in place. Walking beams on which riding weights are planned should be penetration and pressure creosoted, not merely painted along the section which is to support the block.

Since the use of reinforcing in concrete counterweights would in part offset the metals savings effected by making the change-over, all weights should be designed to operate in compression of their own weight only, and should not be subjected to flexing or warping stresses. Properly used, concrete weights release valuable tonnage of needed steel and iron, and revision of existing setups will enable many production units to continue operation while at the same time contributing largely to extended steel plant operation.

Oil Reservoir Behavior Based Upon Pressure-Production Data

By H. C. MILLER
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MORE than 10 years' experience in operating oil fields under proration control has demonstrated to petroleum engineers that some of the efficiency of recovery of oil from reservoir sands and rocks is sacrificed if the oil and gas are withdrawn at too rapid a rate. As petroleum is an irreplaceable natural resource, any producing method that jeopardizes the quantity of oil that may be recovered from underground reservoirs must be considered as conflicting with the best interests of the nation. At best, the efficient recovery of oil is a complex problem. It involves not only a knowledge and application of the fundamentals of fluid flow through porous mediums, but the sources of energy responsible for the movement of oil and gas through reservoir sands and porous rocks to wells must be known to determine the best practices for extracting these hydrocarbons. Reservoir energy is of two kinds—(1) water under hydrostatic head underlying the oil in the extraneous parts of the reservoir system and (2) natural gas under pressure as "free" gas in the reservoir or in solution in the oil.

Inasmuch as the efficiency of oil recovery depends largely on the manner in which reservoir energy is used to move oil through reservoir sands and porous rocks to wells, optimum practices for withdrawing the oil cannot be determined until it has been established that the oil in the reservoirs is being forced to wells by an internal gas expansion, by a natural water drive, or by a combination of gas expansion and water drive.

There is a fundamental difference in the performance characteristics of gas-expansion and water-drive reservoirs. In a strictly gas-expansion reservoir the energy available to move oil and gas through the porous formations to wells results solely from gas pressure, which is maximum when the reservoir is tapped by the first well. Pressures decline as oil and gas are withdrawn; consequently, the energy available for moving oil and gas through the oil-bearing formations to wells decreases with production. Curtailing the oil-production rate or shutting in gas-expansion reservoirs entirely will not act to replenish energy previously used in the production of oil and gas; in their operation, therefore, it is especially important not to waste reservoir energy—the production of oil with high gas-oil ratios will be reflected in lower ultimate recoveries of oil.

Gas-expansion reservoirs are "closed-type" structures that do not outcrop or communicate with the surface of the ground through a porous formation, a fault, or fault zone; for all practical purposes they are lenticular structures in which water may or may not underlie the oil. Any water present in gas-expansion reservoirs is immobile, and the energy which it appears to have (exclusive of its compressibility) is the result of pressure exerted upon it by the gas and not because of a hydrostatic head.

In a water-drive reservoir, the mechanical energy possessed by the oil and gas in the reservoir is the result of the pressure exerted upon them by the column of water in the extraneous part of the reservoir system. Water-drive reservoirs are "open-type" structures, and water entering the reservoir system at the outcrop through a fault or a fault zone, or by way of a porous formation that communicates with the surface of the ground, replenishes energy used in producing oil and gas.

Although the source of energy in water-drive reservoirs is the hydrostatic head of the column of water in the extraneous part of the reservoir system, reservoirs in which the oil is saturated with gas usually yield their first oil as a result of gas expansion. After enough oil and gas have been withdrawn from the reservoirs to extend the established pressure gradients to the physical limits of the reservoir system, the water underlying the oil begins to move as a body into the oil pool. Subsequently, if the volume rate of inflow of water into the extraneous part of the reservoir system is less than the volume rate of outflow of oil and gas from the oil reservoir, a condition experienced during the early producing life of most water-drive reservoirs—the gas associated with the oil expands as it moves toward wells under the influence of declining pressures; at the same time, water enters the oil reservoir as a result of the establishment of a pressure gradient in the reservoir system. Under those conditions oil and gas reach the wells as a result of a combination of gas expansion and water drive.

However, if the volume rate of outflow of oil from a reservoir is controlled (or has declined as a natural consequence of production) so that the volume rate of inflow of water balances volume rate of outflow of oil and gas, reservoir pressures remain constant and the gas associated with the oil has no opportunity to expand, except perhaps in the immediate vicinity of the wells, where, during well operations, the back pressure on the face of the producing formation is less than the pressure within the formation some distance from the wells.

Most water-drive reservoirs pass through three stages during their oil-producing lives—a short period during which oil and gas are forced through the reservoirs to wells as a result of gas expansion, followed by a longer period during which a combination of gas expansion and water drive is the oil-motivating agency, and ending with an extended period during which expanding gas has a negligible influence and oil production is the result mainly of a natural water drive.

Proration has shown the advantages, in greater ultimate oil recovery and lower production costs, to be derived from shortening the time during which gas expansion is an important factor in oil production, in other words, operating a reservoir so as to permit the water drive to move the major part of the recoverable oil to wells. It would be expected, therefore, that in efficiently operated fields every effort is being made to control the production rate so that oil recovery will be the result of a water drive, which accords with the facts.

Inasmuch as the rate of withdrawal of oil and gas from water-drive reservoirs in which the oil is saturated with

gas determines whether the oil moves through the reservoir to wells as a result of (1) gas expansion (usually at a rapid rate with rapid decline of reservoir pressure), (2) a water drive (slow rate with no decline of reservoir pressure), or (3) a combination of gas expansion and water drive (intermediate rate with gradual decline of reservoir pressure), the need for a method for determining the relative importance in oil recovery of each type of drive is apparent.

Reservoir pressures and statistics of oil and gas production are fundamental information of utmost importance in a study of the mechanics of production from reservoirs undergoing depletion of their contained fluids. Such information, covering a period of many years, now is available on a number of petroleum reservoirs and, if wisely interpreted, should prove of inestimable worth in advancing technical knowledge of the producing characteristics of oil-bearing reservoirs.

Appreciating that a study of the past performance of oil reservoirs may aid operators to develop and operate newer fields at greater efficiency, the writer undertook to study a number of reservoirs on which pressure-production information for a period of years was available. Fields with a wide range of producing characteristics were selected for study, so that any differences in their behavior under producing conditions would stand out prominently and invite detailed analytical investigation.

In carrying out the study, customary methods of plotting pressure-production data—for example, reservoir-pressure observations against rates of oil production or against cumulative oil recovery on Cartesian, semilogarithmic, and logarithmic charts—seemed to yield no graphic representations of the mechanics of production of the reservoirs which, by themselves, might picture reservoir performance or aid in an interpretation of the reservoir mechanics. It was found, however, that when the cumulative decline of reservoir pressure was plotted on logarithmic charts against cumulative oil (and water) produced the relationship between them is definable by straight lines for large increments of production. Inasmuch as the relationship between cumulative pressure decline and cumulative oil (and net water) recovery for the producing life of the East Texas field to January 1, 1941, for example, can be represented graphically on a logarithmic chart by two interconnecting, straight lines of different slopes, for the Oklahoma City (Wilcox) field (oil only) by three, and for a number of other fields by not more than four straight, interconnecting lines, it appeared that the suggested method of plotting pressure-production data not only promised to represent graphically the producing performance of petroleum reservoirs but might provide a means for determining the relative efficiency of different methods of operating individual reservoirs.

This report summarizes the study made so far on the cumulative pressure decline-cumulative oil recovery relations found to hold for large increments of produced oil in a number of petroleum reservoirs. The procedure in carrying out the study was first to plot the cumulative decline of reservoir pressure against the corresponding cumulative recovery of oil on logarithmic charts and then to determine, from study of published field reports and by correspondence with engineers familiar with the fields, the significance of the slopes of the most representative straight lines drawn through the plotted pressure-production observations and the reasons for the apparent changes in the slopes of some of the lines.

The results of the study seem to indicate that a plot of the relation between cumulative decline of reservoir pressure and cumulative recovery of oil on logarithmic charts provides a new tool useful in analyzing reservoir performance in fields when oil-production rates are restricted and the wells are not permitted to yield oil at their maximum rate. The writer is not prepared at this time, however, to suggest that the method of plotting pressure-production data discussed in this report will permit comparison of the oil-recovery efficiency of one field with that of another. Perhaps it will be possible to do so after the mechanics of production have been analyzed for many more reservoirs than have been studied so far, but for the present the writer considers the method only as one helpful in determining the producing mechanism in an oil pool and the relative efficiency of different operating methods in the same reservoir.

Graphic Representation on Logarithmic Charts of Relation Between Cumulative Decline of Reservoir Pressures and Cumulative Recovery of Oil

The graphic representations (straight lines) of the relation, on logarithmic charts between cumulative decline of reservoir pressures and cumulative oil recovery may be designated by their slopes or by their slope angles. In this report the writer defines them by their slope angles and considers the slope angle of the plotted logarithmic relation the angle between the line drawn through the cumulative pressure decline-cumulative oil recovery observations and positive x (cumulative oil recovery) axis drawn through a point on the line.

As the discussed relation involves cumulative decline in pressure (a constantly increasing quantity except for reservoirs in which the volume rate of fluid withdrawal balances, or for a short time is less than, the volume rate of inflow of water in the extraneous part of the reservoir system) and cumulative recovery of oil (a constantly augmented quantity), the graphic representation on logarithmic charts of the relation between cumulative decline of reservoir pressure and cumulative oil recovery will (except for reservoirs in which pressures remain constant or increase) slope upward to the right at slope angles that approach +90° as the upper limit. For a reservoir in which pressures remain constant during the production of oil the slope angle is 0°; in other words, the line defining (on a logarithmic chart) the relation between cumulative decline of reservoir pressure and cumulative oil recovery parallels the x axis. Sometimes for small increments of oil recovered, pressures in a producing reservoir increase, and the cumulative decline actually decreases with production of oil. For such conditions, the graphic representations of the relation on logarithmic charts of cumulative decline of reservoir pressure and cumulative oil recovery will slope downward to the right, and the slope angle will approach —90° as the lower limit.

The writer's study shows that when semiannual or annual statistics on cumulative decline of reservoir pressures are plotted on logarithmic charts against corresponding cumulative recoveries of oil, the slope angles of the average lines drawn through the plotted points usually range from 0° (signifying that the reservoir is one of the water-drive type, in which volume inflow of water balances volume overflow of oil and gas) to about +55° for reservoirs in which pressures are declining rapidly, probably as a result of the wasteful production of large volumes of gas with the oil.

Significance of Slope Angle

A straight line having a slope angle of +45° on a logarithmic chart, representing the relation between cumulative decline of reservoir pressure and cumulative recovery of oil from a natural reservoir, signifies that equal quantities of oil were recovered for equal amounts of pressure decline. Slope angles greater than +45° show that each succeeding unit of pressure decline resulted in the recovery of a smaller quantity of oil;

[1] For a discussion of the energy sources in the East Texas field see Schilthuis, Ralph J., and Hurst, William, Variations in Reservoir Pressure in the East Texas Field: Trans. Am. Inst. Min. and Met. Eng., Petrol. Devel. and Technol., 1935, vol. 114, pp. 164-176. Also, see Buckley, Stuart E., The Pressure-Production Relationship in the East Texas Field: Oil Weekly, vol. 89, No. 5, April 11, 1938, pp. 19-34.

TABLE 1

Cumulative Oil Recovered for Cumulative Decline of Reservoir Pressure of 1 to 10 Units for 4 Slope Angles

Cumulative Decline or Reservoir Pressure, Pressure Units	Cumulative Oil Recovered for Designated Slope Angles, Volume Units			
	+15°	+30°	+45°	+60°
1	1	1	1	1
2	13.3	3.3	2	1.5
3	60.3	6.7	3	1.9
4	176.6	11.0	4	2.2
5	405.5	16.3	5	2.5
6	801.8	22.3	6	2.8
7	1,425	29.1	7	3.1
8	2,346	36.7	8	3.3
9	3,641	45.0	9	3.6
10	5,396	54.0	10	3.8

slope angles less than +45° and greater than 0° indicate, on the other hand, that each succeeding unit of pressure decline had been instrumental in causing the recovery of an increasingly greater quantity of oil from the reservoir.

Table 1 shows the cumulative quantity of oil recovered for a cumulative decline of reservoir pressure increasing by uniform increments from 1 to 10 units, for reservoirs for which the relation between cumulative decline of reservoir pressure and cumulative oil recovery is represented on logarithmic charts by straight lines having slope angles of +15°, +30°, +45°, and +60°. In calculating the data given in the table, it is assumed that one unit of oil had been recovered for the first unit of decline in pressure.

The data in Table 1 indicate that the closer the scope angle is to 0°, the larger the quantity of oil recovered for a given increment of pressure decline. It should follow, then, that any change in the operation of a reservoir that results in decreasing the slope angle of the relation between cumulative decline of reservoir pressure and cumulative oil recovery increases the efficiency of utilization of reservoir energy. On the other hand, if the slope angle increases after a change has been made in the rate of withdrawal of oil from the reservoir or in gas-oil ratios, the larger slope angle should indicate a lower efficiency of utilization of sources of energy. Therefore, as this study shows that a large, positive slope angle indicates that the major source of the energy that drives oil to wells in a water-drive reservoir is the gas associated with the oil under pressure, and as a slope angle of 0° means that the oil is being moved to wells solely by a water drive, it may be concluded that the smaller the slope angle for a given reservoir, the greater the relative effect of the water drive on oil recovery as compared to the gas drive resulting from the expansion of gas in the reservoir. However, it does not follow necessarily that a slope angle of 0° always indicates maximum efficiency of oil recovery from a water-drive reservoir. A change from a positive slope angle to one of 0° for a reservoir producing gas-saturated oil indicates a transition in the reservoir from a combination of gas (or water) expansion and water drive to water drive alone. Expanding gas or water no longer supplies energy to move oil through the sands and porous rocks to wells in a reservoir whose logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery is represented on a logarithmic chart by a straight line with a slope angle of 0°; the oil is propelled wellward entirely by a water drive, and the efficiency of oil recovery depends, at least to a large degree, on the rate of water encroachment. Idealized laboratory experiments performed by Miller[2] show that within the usual rate of edgewater encroachment in oil reservoirs the faster the rate of water movement in an oil-filled sand column the greater the percentage of original oil recovered. A rapid rate of water advance in a natural reservoir, however, may cause water to "finger" into the oil sand and lower the efficiency of oil recovery, so that the optimum rate of water encroachment may not be the maximum rate at which water can advance into an oil-bearing formation. In general, however, it is recognized that the efficiency of oil recovery by water drive is greater than that by gas expansion, and Moore[3] cites figures for comparative purposes showing that whereas recovery under a uniform water drive may be 75 percent, a complete gas drive may recover 48 percent and an incomplete gas drive only 25 percent of the oil originally in place in a reservoir.

In a gas-expansion reservoir, gas under pressure is the sole source of energy available to move oil through the reservoir sands and rocks to wells; pressures decline continuously as oil is withdrawn, and the logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery always has a positive slope angle. Information on the pressure-production behavior of gas-expansion reservoirs in the United States producing important quantities of oil is not plentiful. Preliminary study of a limited quantity of incomplete data, however, indicates that the slope angles for the logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery—at least during the early producing life of gas-expansion reservoirs—probably are about +45°.

TABLE 2

Cumulative Oil Recovery, Reservoir Pressures, Cumulative Decline of Reservoir Pressure, and Gas/Oil Ratios, Jones Pool, Shuler Field, Arkansas, 1938-40, Inclusive[1]

DATE	Cumulative Oil Recovery, Bbl.	Reservoir Pressure at 7,300 Feet Subsea, Lb. Per Sq. In.	Cumulative Decline of Reservoir Pressure, Lb. Per Sq. In.	Gas/Oil Ratios, Cu. Ft. Per Bbl.
		[2]3,520		
1938, Jan. 1	345,567	3,460	60	500
July 1	2,221,816	3,154	366	871
1939, Jan. 1	5,571,965	2,774	746	1,028
July 1	8,275,900	2,468	1,052	1,118
1940, Jan. 1	10,789,345	2,291	1,229	1,270
July 1	13,531,421	1,961	1,559	2,172
1941, Jan. 1	16,131,686	1,620	1,900	2,850

[1] Data furnished by the Arkansas Oil and Gas Commission. [2] Original reservoir pressure.

Pressure-Production Relations in Typical Oil Fields

Jones Pool, Shuler Field

Statistics of oil production, reservoir pressures, and gas-oil ratios for the Jones pool in the Shuler field, Arkansas, are given in Table 2.

When semiannual observations of the cumulative decline of reservoir pressure for the Jones pool in the Shuler field are plotted on a logarithmic chart against the cumulative quantity of oil recovered to January 1, 1941, the best representative straight line drawn through the plotted points has a slope angle of +40°. (See graph A, Figure 1.)

Early drilling revealed the existence of a gas cap in the Jones reservoir, and its presence indicates that the oil in the reservoir is saturated with gas at reservoir pressure and temperature. The oil in the reservoir is underlain by water, but as the reservoir pressure during a state-wide shutdown (August 17 to September 4, 1939) increased only 18 (initially reported as 16 pounds per square inch[4], engineers familiar with operation in the field concluded that there is no active water drive in the reservoir and for some time thought that the energy to move oil through the sand to wells was derived entirely from the expansion of the gas in the gas cap and that which came out of solution in the oil as reservoir pressures declined. The failure of reservoir pressures to increase materially during the extended shutdown of the field was interpreted by some engineers to indicate that the Jones pool is a gas-expansion reservoir and does not outcrop or communicate with the surface of the ground, except at the wells.

During 1941, however, after the reservoir pressure had declined to about 1600 pounds per square inch (45 per-

[2] Miller, Frank G., A Laboratory Study of Water Encroachment in Oil-Filled Sand Columns: Bureau of Mines Rept. of Investigations 3595, 1941, 32 pp.

[3] Moore, T. V., A Review of the Principles of Oil-Recovery Performance: Am. Petrol. Inst., Drilling and Production Practice, 1940, p. 98.

[4] Although there was an indicated increase of reservoir pressure of 18 pounds per square inch, during the state-wide shutdown, when the average pressure was calculated on an areal basis, when the data on the pressure-contour maps were weighted volumetrically (based upon the estimated thickness of formation), it was found that the pressure remained almost constant during the period. See Crowell, Alec M., Data on Gas-Driven Pool Discloses Characteristics Differing from Water-Driven Reservoirs: Petrol. Eng., October 1939, p. 29.

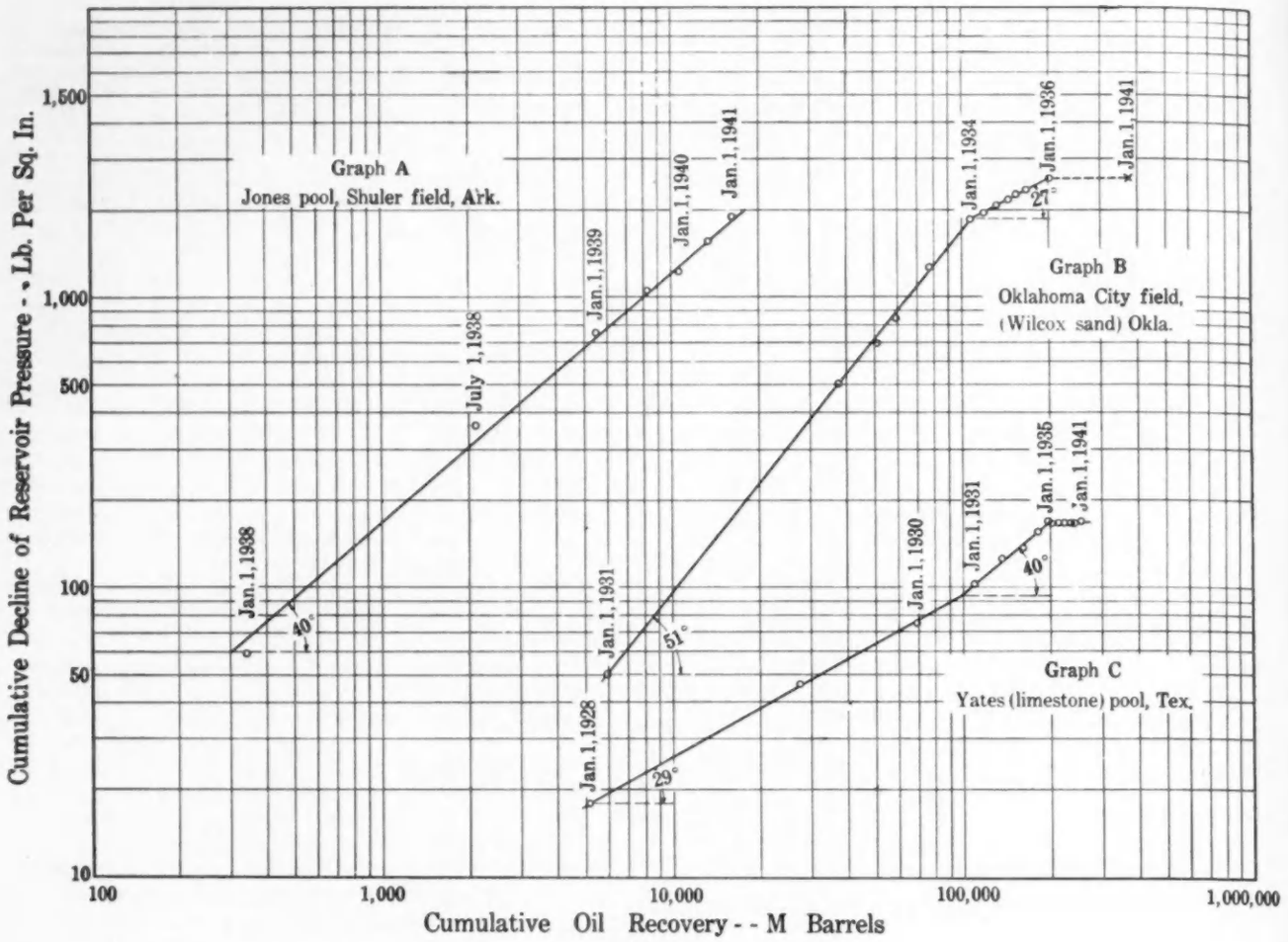


FIGURE 1

Pressure decline-oil recovery relations in the Jones pool, Shuler field, Arkansas; in the Oklahoma City field (Wilcox sand), Oklahoma; and in the Yates (limestone) pool, Texas.

cent of the original pressure) and gas-repressuring had been initiated, certain wells in the northern and western parts of the Shuler-Jones field began to produce salt water in varying quantities. The entrance of water in the flank wells indicates to the writer that edgewater is encroaching upon the oil-bearing part of the reservoir and that the reservoir, therefore, is not one of the closed type. Hence, it may be assumed that for some time edgewater has moved slowly into the oil reservoir and probably has had some effect on oil recovery. The large slope angle (+40°) for the logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery (to January 1, 1941) may be interpreted, then, as indicating not only that the oil-motivating agent was a combination of gas expansion and water drive, but that it predominately was gas expansion. Consideration of the large slope angle, plus the size and trend of gas-oil ratios, which at the end of 1940 were more than five times greater than at the beginning of the producing life of the Jones reservoir, seems to indicate that large volumes of gas escaped from the reservoir without bringing their quotas of oil to the wellheads. The bottom of the oil strings in most wells in the field was below the top of the oil-producing formation, and the oil strings were gun-perforated low in the oil-saturated section of the producing sand. Nevertheless the rising gas-oil ratios probably may be interpreted as evidence that considerable gas entered the wells from the rapidly growing gas cap. As escaping gas from a gas cap has energy by reason of the gas-pressure head in the reservoir, its dissipation without doing useful work in moving oil to wells may have been responsible, at least in part, for the accelerated decline of reservoir pressure per unit volume of oil produced, as reflected in the large slope angle for the logarithmic relationship between cumulative decline of reservoir pressure and cumulative oil recovery.

Oklahoma City Field

Table 3 gives statistical information on the cumulative quantity of oil recovered and corresponding reservoir pressures and cumulative decline of reservoir pressure in the Wilcox zone of the Oklahoma City field from February, 1930, through 1940.

A plot on a logarithmic chart (graph B, Figure 1) of the tabulated observations of cumulative decline of reservoir pressure and cumulative oil recovery shows that the pressure-production history of the Wilcox zone to January 1, 1941, can be represented graphically by three interconnected, straight lines having widely different slope angles. The line representing the relation between cumulative decline of reservoir pressure and cumulative oil recovery for the early producing life of the Wilcox zone (to January 1, 1934, when cumulative oil recovery was approximately 106,000,000 barrels) has a slope angle of +51°. During recovery of the next 94,000,000 barrels of oil (to a cumulative recovery of 200,491,595 barrels of oil as of January 1, 1936), reservoir pressures declined to an estimated pressure of 50 pounds per square inch at a subsea depth of 5100 feet, and the line on the logarithmic chart defining the relation between cumulative decline of reservoir pressure and cumulative oil recovery has a slope angle of +27°.

TABLE 3

Cumulative Oil Recovery, Reservoir Pressures, and Cumulative Decline of Reservoir Pressure, Wilcox Sand, Oklahoma City Field, Oklahoma, 1930-40, Inclusive[1]

DATE	Cumulative Oil Recovery, Bbl.	Reservoir Pressure at 5,100 Feet Subsea, Lb. Per Sq. In.	Cumulative Decline of Reservoir Pressure, Lb. Per Sq. In.
1930, Feb.		[2]2,600	
1931, Jan. 1	5,876,148	[2]2,550	50
1932, Jan. 1	37,803,925	[2]2,100	500
July 1	50,477,494	1,910	690
1933, Jan. 1	59,760,799	1,760	840
July 1	77,500,962	1,330	1,270
1934, Jan. 1	106,788,012	750	1,850
Apr. 1	119,655,401	650	1,950
July 1	133,518,325	540	2,060
Oct. 1	145,010,966	420	2,180
1935, Jan. 1	156,214,859	370	2,230
Apr. 1	167,643,222	270	2,330
1936, Jan. 1	200,491,595	350	2,550
1937, Jan. 1	[4]240,778,299	542 [6]30.6	.....
1938, Jan. 1	[4]285,933,861	[7]20.2	.....
1939, Jan. 1	[4]317,031,492	[8]8.2	.....
1940, Jan. 1	[4]346,712,186	[9]8.2	.....
1941, Jan. 1	[10]377,148,240	[11]	.....

[1] Unless otherwise noted, data are from Hill, H. B., Rawlins, E. L., and Bopp, C. R., Engineering Report on Oklahoma City Oil Field: Bureau of Mines Rept. of Investigations 3330, 1937, pp. 71-77.

[2] Original reservoir pressure.

[3] Estimates.

[4] Data from Trans. Am. Inst. Min. and Met. Eng., Petrol. Devel. and Technol., vol. 118, 1936, p. 334; vol. 123, 1937, p. 434; vol. 127, 1938, p. 479; vol. 132, 1939, p. 387; vol. 136, 1940, p. 363.

[5] Average reservoir pressure (excluding Mansion area) on April 1, 1937.

[6] Average reservoir pressure (including Mansion area) at 5,200 feet subsea on October 1, 1937.

[7] Average reservoir pressure (including Mansion area) at 5,200 feet subsea on April 1, 1938.

[8] Average reservoir pressure (including Mansion area) at 5,200 feet subsea on January 1, 1939.

[9] Average reservoir pressure (including Mansion area) at 5,200 feet subsea on July 1, 1939.

[10] Data given in footnotes 5 to 11, inclusive furnished by R. E. Heithecker, Bureau of Mines.

[11] Reservoir pressures in 1940 were taken at 5,260 feet subsea, but no average pressure was computed.

Subsequently (to January 1, 1941), the slope angle is approximately +2°, indicating that the production of approximately 177,000,000 barrels of oil was accompanied with an exceeding small decline of reservoir pressure.

Study of the producing history of the Oklahoma City field shows that the Wilcox sand was discovered in 1929, when the discovery well "blew out" and dissipated large volumes of gas into the air for several days before it produced small quantities of oil, which increased rapidly to 40,000 to 60,000 barrels a day[5]. The fact that the discovery well blew gas for several days before producing oil indicates that the well penetrated a gas cap. Subsequently other small gas caps in a few remote regions of the reservoir were penetrated by wells, proving that the oil in the reservoir was saturated with gas.

The large volume of gas produced from the Wilcox zone in the Oklahoma City field, estimated to have been about 800 billion cubic feet, is further evidence suggesting that the oil originally was saturated with gas. Gas-oil ratios of production are not available for the early years of the reservoir's producing life, but a tabulation[6] of continuous gas-oil ratios for a large group of wells completed generally in the Wilcox zone shows that for 1934 and 1935 formational gas-oil ratios ranged from about 1000 to slightly more than 3000 cubic feet per barrel.

The pressure in the Wilcox reservoir originally—at a subsea datum of 5100 feet—was estimated to have been 2600 pounds per square inch, or slightly less than the calculated hydrostatic pressure in the reservoir based on elevation of the Wilcox outcrop in the Arbuckle Mountains[7].

Of further interest in the analytical study of the mechanics of production of the Wilcox reservoir in the Oklahoma City field is the reported early movement and final stoppage of the edgewater. The oil-water contact was calculated to have been at a depth of 5425 feet below sea level in June, 1930; in February, 1932[8], the contact was at a subsea depth of 5370 feet. Although edgewater continued to move into the oil-bearing part of the Wilcox reservoir for some time after 1932, encroachment virtually ceased by 1935 or 1936, and since then there has been no noticeable upward movement of water in the oil-bearing sand. Shortly after January 1, 1936, pressures in the Wilcox reservoir at a subsea datum of 5100 feet virtually were atmospheric, and petroleum engineers credit gravity drainage with the production of most of the oil recovered during recent years. Nevertheless, as the Wilcox sand outcrops in the Arbuckle Mountains and edgewater encroached for a time into the oil-bearing sands, the Wilcox reservoir in the Oklahoma City field must be classified as a water-drive reservoir under the definition as given in this paper.

During the early producing life of the field, production of large unmeasured volumes of gas with the oil undoubtedly contributed in large measure to the excessive rate of decline of reservoir pressure; much of the gas probably bypassed oil in the reservoir as it moved toward wells. The +51° slope angle for the logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery (106,000,000 barrels) indicates that a decreasing quantity of oil was recovered for successive unit increments of pressure decline and is believed to reflect the inefficient (wasteful of reservoir energy) operations accompanying the recovery of the first 106,000,000 barrels of oil from the reservoir.

Although the average reservoir pressure had declined to 750 pounds per square inch by January 1, 1934, subsequent field operations, which resulted in the production of an additional 94,000,000 barrels of oil, apparently were more efficient than those in effect during the early producing life of the Wilcox reservoir. The change in the pressure-production relation from one having a slope angle of +51° to one of +27° indicates a relatively great improvement in the degree of utilization of reservoir energy, as is evident when it is considered that the last 100-pound-per-square-inch increment of pressure decline in 1933 (slope angle, +51°) yielded approximately 4,800,000 barrels of oil, and an increment of pressure decline of the same magnitude in 1934, when the slope angle was +27°, resulted in the recovery of approximately 11,600,000 barrels of oil, or more than twice as much as in 1933.

The slope angle of approximately +2° for the relation between cumulative decline of reservoir pressure and cumulative oil recovery in the Wilcox reservoir after about January 1, 1936, ordinarily would indicate, for a water-drive reservoir yielding gas-saturated oil, that the oil moved to the wells almost entirely as a result of a natural water drive. Average reservoir pressures have been close to atmospheric since 1936, so that expanding gas could have furnished only a small part of the energy required to produce oil. However, as edgewater reportedly did not move into the oil-bearing sand it must be concluded that the movement of oil to wells since 1936 was due principally to gravitational forces.

The relation between cumulative decline of reservoir pressure and cumulative recovery of much of the oil from the Wilcox sand agrees with that which would be expected normally from any water-drive reservoir yielding gas-saturated oil where early producing operations, generally considered wasteful of reservoir energy, were followed by more efficient field operations. Nevertheless, the over-all producing performance of the Wilcox reservoir in the Oklahoma City field is unique among the oil fields of the nation, in that the apparent stoppage of movement of edgewater in the oil-bearing sands after the withdrawal of a large quantity of oil from the reservoir has no counterpart in the history of production of the major oil fields.

Yates (Limestone) Pool

Statistics of oil production and reservoir pressure for the Yates (limestone) pool for 1927 through 1940, are given in Table 4.

Graph C (Figure 1) shows that the average relation between cumulative decline of reservoir pressure and cumulative oil recovery to January 1, 1941, for the Yates pool can be represented

[5] McGee, D. A., and Clawson, W. W., Jr., Geology and Development of Oklahoma City Field, Oklahoma County, Okla., Bull. Am. Assoc. Petrol. Geol., vol. 16, No. 10, October 1932, p. 994.

[6] Hill, H. B., Rawlins, E. L., and Bopp, C. R., Engineering Report on Oklahoma City Oil Field, Oklahoma: Bureau of Mines Rept. of Investigations 3330, 1937, p. 163.

[7] Hill, H. B., Rawlins, E. L., and Bopp, C. R., Work cited in footnote 6.

[8] McGee, D. A., and Clawson, W. W., Jr., Work cited in footnote 5.

TABLE 4

Annual and Cumulative Oil Production, Reservoir Pressures, and Cumulative Decline of Reservoir Pressure, Yates (Limestone) Pool, Texas, 1927-40, Inclusive[1]

YEAR	Oil Production, Bbl.		Reservoir Pressure at 1,300 Feet Above Sea Level, Lb. Per Sq. In.	
	Annual	Cumulative	End of Year	Cumulative Decline
1927	[2]5,176,313	5,176,313	[3]700 (est.)	
1928	[3]22,328,886	27,505,199	[3]682 (est.)	18
1929	[3]41,336,913	68,842,112	[3]654 (est.)	46
1930	[3]40,384,869	109,226,979	[3]598.7	74
1931	[3]27,127,209	136,354,188	[3]576.3	101.3
1932	22,801,042	160,051,206	[3]564.3	123.7
1933	20,228,277	180,279,483	[3]547.1	135.7
1934	15,409,209	195,688,692	[3]532.6	152.9
1935	15,197,819	210,886,511	[3]532.3	167.4
1936	12,214,156	223,100,667	[3]536.2	167.7
1937	10,558,488	232,920,321	535	163.8
1938	6,728,426	239,664,668	533	165
1939	7,737,871	247,403,819	532	167
1940	[4]6,861,864	254,265,683	[4]530.8	168 169.2

[1] Unless otherwise noted, sources of all data were the annual transactions of the Am. Inst. Min. and Met. Eng., Petrol. Devel. and Technol.
[2] Original reservoir pressure.
[3] Data from "A Discussion of the Exhibits Presented by the Railroad Commission of Texas at the Interstate Oil Compact Commission Meeting in Oklahoma City, January 18, 1938." Mimeographed report.
[4] Data furnished by Peter P. Gregory, chairman, Yates Pool Engineering Committee, Iraan, Tex.

graphically on a logarithmic chart by three interconnecting, straight lines. For the first 3 years of the reservoir's producing life (during which approximately 98,000,000 barrels of oil were recovered and reservoir pressures declined 92 pounds per square inch), the slope angle of the straight line representing the logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery is +29°; for the next 100,000,000 barrels of oil recovery (to January 1, 1935) the slope angle is +40°; and for the last 56,000,000 barrels of oil withdrawn from the reservoir (to January 1, 1941) the slope angle is approximately 0°.

The limestone reservoir in the Yates field — found at depths ranging from 1100 to 1800 feet below the surface of the ground—was discovered in 1927. According to Albertson and Schaeffer,[10] the field outlet has always been prorated, and gas-oil ratios that originally ranged from less than 100 to 8000 cubic feet averaged about 500 cubic feet per barrel at allowable production rates.

The pressure in the reservoir at a sea-level datum of +1300 feet at the time of discovery is estimated to have been 700 pounds per square inch, and early gas-oil ratios indicate that the oil in the reservoir is saturated with gas. Production reached a peak in 1929, when 41,336,913 barrels of oil was withdrawn from the pool; almost as much oil (40,384,869 barrels) was obtained during 1930. The following year, however, oil-production rates were curtailed materially, and only 27,127,209 barrels of oil was produced.

The logarithmic plot of cumulative decline of reservoir pressure and cumulative oil recovery shows that the straight line defining the relation between them assumed a different slope sometime during 1930, at the time when cumulative recovery of oil amounted to approximately 98,000,000 barrels, and that the slope angle increased from +29° to +40°. The increase in the slope angle indicates to the writer that the efficiency of the utilization of reservoir energy decreased some time in 1930; the smaller quantity of oil recovered per unit decline of reservoir pressure immediately after the change in the slope angle indicates the relative decrease in efficiency. An increment of pressure decline of 10 pounds per square inch immediately before the change in the slope angle yielded approximately 18,200,000 barrels of oil, whereas a decline in pressure of identical magnitude immediately following the change in the slope angle yielded only about 12,800,000 barrels of oil. Even 4 years later, while the slope angle of the relation between cumulative decline of reservoir pressure and cumulative oil recovery still was +40°, a decline in reservoir pressure of 10 pounds per square inch yielded only about 15,200,000 barrels of oil, or still 240,000 barrels less per 1-pound-per-square-inch drop of reservoir pressure than immediately before the slope angle changed from +29° to +40°.

If the writer's interpretation of the significance of the change in slope angles is correct, the conclusion that the efficiency of oil recovery was higher before about the middle of 1930 than from then on to about January 1, 1935, is contrary to that generally supposed to have been the result of the formulation and placing into effect of a gas-conservation program in 1931. Many engineers report that oil-recovery practices in the Yates field improved after 1931 and that they were of the opinion that the efficiency of utilization of reservoir energy likewise was greater after 1931 than it had been before initiation of the gas-conservation program. The writer's study, however, does not indicate attainment of the generally supposed greater recovery efficiencies, and it is his conclusion that in a reservoir in which expanding gas and encroaching water are the oil-motivating agents, a slight curtailment of oil-producing rates actually may result sometimes in decreasing the efficiency of oil recovery. The economic need, however, for a material curtailment of oil-production rates in the Yates pool was a paramount consideration of the operators, and even if curtailment temporarily resulted in lower recovery efficiencies, edgewater under hydrostatic head eventually moved into the oil-bearing rocks to replenish some or all of the energy dissipated previously without corresponding oil recovery.

[10] Albertson, M., and Schaeffer, W. A., Jr., Control of Gas-Oil Ratios in the Yates Field, Pecos County, Texas: Trans. Am. Inst. Min. and Met. Eng., Petrol. Devel. and Technol., 1932, p. 315.
[11] Young, Addison, David, Max, and Wahlstrom, E. A., Goldsmith Field, Ector County, Texas: Bull. Am. Assoc. Petrol. Geol., vol. 23, No. 10, October 1939, p. 1537.

TABLE 5

Cumulative Oil Recovery, Reservoir Pressures, and Cumulative Decline of Reservoir Pressure, Goldsmith Field, Texas, 1935-40, Inclusive[1]

YEAR	Cumulative Oil Recovery, Bbl.	Reservoir Pressure at 800 Feet Below Sea Level (End of Year), Lb. Per Sq. In.	Cumulative Decline of Reservoir Pressure, Lb. Per Sq. In.
		[2]1,675	
1935	65,019	1,657 (est.)	18
1936	492,386	1,617	58
1937	3,800,189	1,470	205
1938	9,195,168	1,431	244
1939	16,582,027	1,411	264
1940	24,558,169	1,397	278

[1] Data from annual transactions of Am. Inst. Min. and Met. Eng., Petrol. Devel. and Technol.
[2] Estimated original pressure.

Since about January 1, 1935, when cumulative oil recovery totaled 195,688,692 barrels, the rates of oil production from the Yates pool have been restricted to a much greater degree than at any previous time during the producing life of the field. As a result of holding back production to market demand, the rate of outflow of oil balanced the rate of inflow of water in the extraneous part of the reservoir system, as is indicated by virtually no decline of reservoir pressure since January, 1935.

Intersection of the two straight lines shown on graph C, Figure 1 (one with a slope angle of +40° and the other with a slope angle of 0°), defining on a logarithmic chart the relations between cumulative decline of reservoir pressure and cumulative recovery of oil, indicates that the transition from a motivating force derived from a combination of gas expansion and water drive to a water drive in the reservoir occurred about the time that the pool's cumulative production totaled 195,000,000 barrels of oil, or about January 1, 1935.

Goldsmith Field

Statistics of the quantity of oil recovered and reservoir pressures in the Goldsmith field for 1935 through 1940 are given in Table 5.

As shown by graph A, Figure 2, the relation between cumulative decline of reservoir pressure and cumulative recovery of oil for the Goldsmith pool may be represented on a logarithmic chart by two interconnecting straight lines having respective slope angles of +31° and +7°.

According to Young, David and Wahlstrom,[11] whose published report on the Goldsmith field is drawn upon freely in the discussion that follows, gas, oil and water, in the order listed, are found at nearly constant subsea levels. The existence of gas above the oil in the reservoir indicates that the oil is

saturated with gas. It is reported, also, that large volumes of gas were produced with the oil during the early producing life of the pool. Although it was not until 1937 that exploitation of the field developed into a campaign of intensive drilling, the slope angle (+31°) of the early relationship between cumulative decline of reservoir pressure (to a cumulative decline of about 225 pounds per square inch) and cumulative oil recovery (about 4,500,000 barrels) indicates that a combination of expanding gas and water drive was the motivating force moving the oil through the reservoir to wells.

The effect of improved well operations on the efficiency of utilization of the reservoir energy is apparent by the change that took place in the slope angle early in 1938, or about the time cumulative recovery equaled 4,500,000 barrels of oil. Remedial work on high gas-oil ratio wells was started early in the producing life of the field and was stimulated by placing a penalty on each well producing more than 5000 cubic feet of gas per barrel of oil, a reduced allowable proportionate to the fraction of 5000 cubic feet divided by the actual producing gas-oil ratio. As a result of basing daily oil allowables of wells in part on gas-oil ratios—the higher the ratio (above 5000), the less oil a well was permitted to produce per day—the average field gas-oil ratio declined from about 5500 in April, 1937, to about 2100 cubic feet per barrel in November, 1937.

[12] Christie, R. S., Reservoir Pressures in the Hobbs Field, New Mexico: Trans. Am. Inst. Min. and Met. Eng., Petrol. Devel. and Technol., 1932, p. 342.

Operators also gave early consideration to methods of improving well completions and to operating wells in accordance with best-known practices, and the partial attainment of the desired improvement in increased efficiency of utilization of reservoir energy is reflected by the small slope angle (+7°) after about 4,500,000 barrels of oil had been withdrawn from the reservoir. Whereas only about 325,000 barrels of oil was recovered for a decline of reservoir pressure of 10 pounds per square inch immediately before the slope angle changed, an identical increment of pressure decline immediately following the change yielded about 2,000,000 barrels of oil. In other words, the minimum quantity of oil recovered per 10-pound-per-square-inch decline of reservoir pressure when the slope angle was +7° was six times the maximum quantity of oil recovered for the same unit of pressure decline when the relation between cumulative decline of reservoir pressure and cumulative oil recovery was definable on a logarithmic chart by a straight line having a slope angle of +31°.

Young, David, and Wahlstrom[11] recorded in their report that "there is some evidence (June, 1939) that the gas caps are expanding and the bottom-water level is moving upward" in the Goldsmith pool. The writer believes that the slope angle (+7°) at that time indicates positively that oil production resulted partly from gas expansion but to a larger degree from a water drive.

Hobbs Field, Lea County, New Mexico

Statistics on oil production and reservoir pressures in the Hobbs field for 1930 through 1940 are given in Table 6.

The Hobbs field was discovered in 1928, but intensive development did not begin until after a well yielding an average of 7275 barrels of oil a day for 23 days had been completed in February, 1930. The oil-producing horizon in the Hobbs field is a porous limestone in which the initial pressure at a subsea depth of 400 feet is estimated to have been 1550 pounds per square inch. Water under hydrostatic head underlies the oil, and there is gas in the crest of the oil-bearing structure. Initial gas-oil ratios ranged from 325 to 16,000 cubic feet per barrel[13]—small ratios when the top of the producing horizon was below a subsea depth of 350 feet and large ratios when it was above that depth.

Although efforts to conserve reservoir energy in the Hobbs field began almost simultaneously with its initial development, the problem of reducing high gas-oil ratios proved difficult, and remedial measures were not always successful. Water encroachment also presented a problem that has not been solved entirely. Despite the success of plugging operations in reducing the quantity of water entering many of the wells, the percentage of water in the liquid withdrawn from the reservoir increased from less than 4.5 percent in 1932 to 54 percent in 1940.

As shown by graph B, Figure 2, the logarithmic relationship between cumulative decline of reservoir pressure and cumulative recovery of oil from the Hobbs pool to January 1, 1940, by which time probably 70 to 75 percent

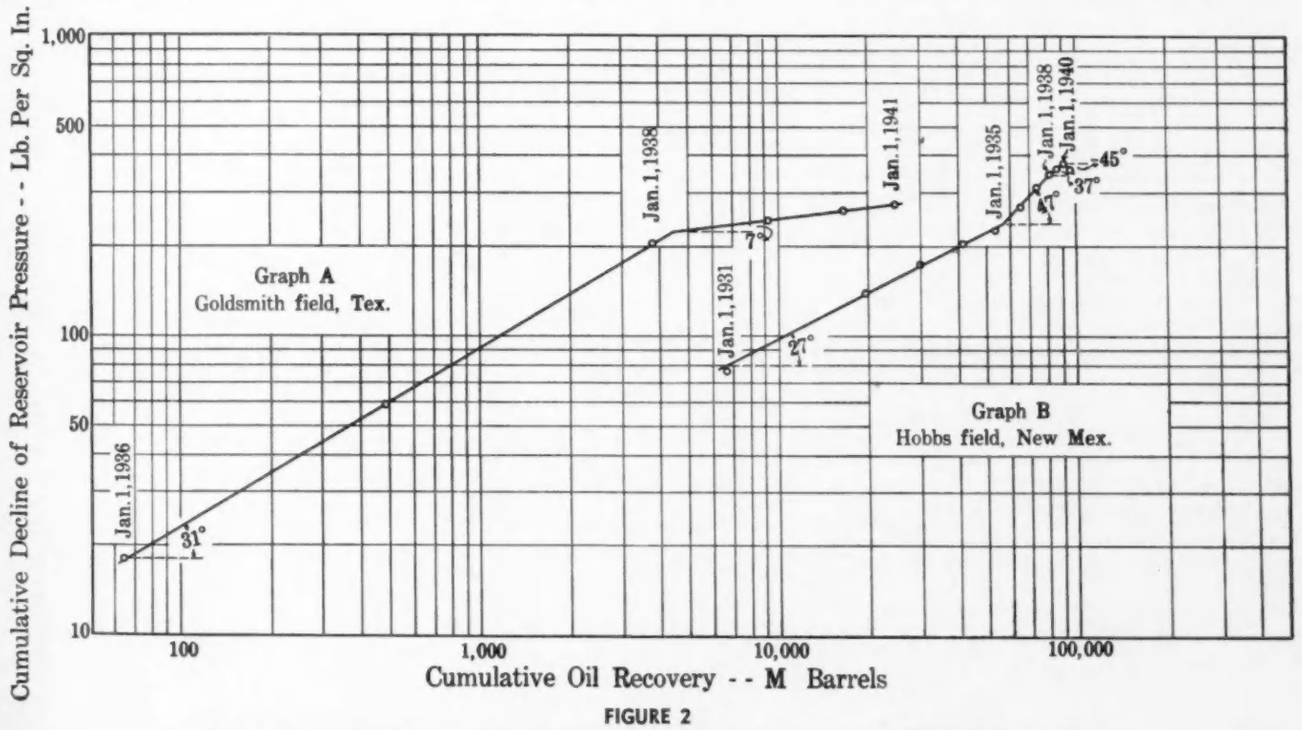


FIGURE 2

Pressure decline-oil recovery relations in the Goldsmith field, Texas, and the Hobbs field, New Mexico.

TABLE 6

Cumulative Oil Recovery, Reservoir Pressures, and Cumulative Decline of Reservoir Pressure, Hobbs Field, New Mexico, 1930-40, Inclusive[1]

YEAR	Cumulative Oil Recovery, M Bbl.	Reservoir Pressure at 400 Ft. Subsea (End of Year), Lb. Per Sq. In.	Cumulative Decline of Reservoir Pressure, Lb. Per Sq. In.
		[2]1,550	
1930	6,662	1,484	76
1931	19,430	1,410	140
1932	29,577	1,376	174
1933	40,988	1,346	204
1934	53,452	1,324	226
1935	64,521	1,276	274
1936	73,573	1,233	317
1937	80,866	1,202	348
1938	85,876	1,188	362
1939	90,316	1,171	379
1940	94,112	1,188	362

[1] Based upon data furnished by Glenn Staley, chairman, engineering committee, Lea County Operators Committee, Hobbs, N. Mex.
[2] Estimated original pressure.

of the recoverable oil had been produced, can be defined by three straight lines having slope angles of +27°, +47° and +37°, respectively.

Soon after January, 1935, the Hobbs pool had yielded its first 56,000,000 barrels of oil and reservoir pressures had declined 235 pounds per square inch. The logarithmic relation of these increments of cumulative decline of reservoir pressure and cumulative oil recovery has a slope angle of +27°. Based upon the writer's study of the pressure-production relations for many reservoirs, a slope angle of +27° indicates the recovery of oil to be a result of a combination of gas expansion and water drive, a conclusion that seems to be verified for the Hobbs pool by a study of the reservoir's gas-oil ratios and water production. During the first 5 years of the reservoir's producing life, gas-oil ratios averaged about 1300 cubic feet per barrel. As the volume of gas in solution in a barrel of oil in the reservoir originally was only approximately 800 cubic feet[13] (measured at standard conditions of temperature and pressure) all of the gas produced with oil in excess of that in solution probably did not come from the gas cap, but some of it no doubt came from solution in the oil and, in expanding under declining reservoir pressures, forced oil through the reservoir rocks to wells. Furthermore, the percentage of water produced with the oil increased from virtually 0 percent in 1930 to 11.5 percent in 1934, suggesting that the water drive also must have been responsible for the movement of some oil to wells.

Apparently the efficiency of utilization of reservoir energy in the Hobbs pool decreased shortly after January, 1935, because the slope angle of the logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery increased at about that time from +27° to +47°. From some time shortly after January, 1935, to January 1, 1938, the daily average production of oil declined from about 31,000 to approximately 15,000 barrels a day; the quantity of water produced increased from about 3000 to 8000 barrels a day, and average gas-oil ratios increased from 1300 to 2200 cubic feet a barrel. Thus, at the beginning of 1938, about 900 more cubic feet of gas were being produced per barrel of oil, or 270 more cubic feet of gas per barrel of oil and water, than during the early part of 1935. Also, whereas an average of 566,000 barrels of oil was recovered for a drop of pressure of 1 pound per square inch during 1934, when the slope angle of the logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery was +27°, only 225,000 barrels of oil—only 40 percent as much—was recovered for a similar drop of pressure during the next 3 years, when the slope angle was +47°. Apparently, then, even though the efficiency of utilization of reservoir energy before 1935 has not been established, the cited comparisons of oil, gas, and water production as well as the pressure drops indicate that the efficiency was greater before 1935, when the slope angle was +27°, than during 1935, 1936, and 1937, when the slope angle was +47°.

After January, 1938, the rate of decline of oil production was less rapid than at any time since the beginning of 1935; gas-oil ratios also declined, but the production of water continued at an accelerated rate. By January, 1940, the average daily rate of oil production was 11,600 barrels; gas-oil ratios were about 1700 cubic feet a barrel, and on the average approximately 11,250 barrels of water was produced a day. The slope angle of the logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery for the period January, 1938, to January, 1940, is +37°, indicating not only that the oil still moved through the reservoir rocks to wells as the result of a combination of gas expansion and water drive, but that the efficiency of utilization of reservoir energy was slightly greater than during the preceding 3 years, when the slope angle was +47°. The fact that 500 less cubic feet of gas accompanied a barrel of oil to the wellheads during December, 1939, than reached the surface of the ground with a barrel of oil in January, 1938, indicates, also, that the water drive moved a greater proportion of the oil through the reservoir rocks to wells than during the years for which the slope angle was +47°.

Reservoir pressures increased 17 pounds per square inch from January 1, 1940, to January 1, 1941, indicating that the volume rate of inflow of water into the Hobbs reservoir exceeded the volume arte of outflow of fluids through wells. For 1940, therefore, the logarithmic relation between cumulative decline of reservoir pressure and cumulative recovery of oil has a negative slope angle (—45°), indicating that during 1940 expanding gas had not been a factor in oil recovery and that a water drive moved the oil through the reservoir rocks to wells.

[13] Andres, A., New Mexico State geologist. Report accompanying oral testimony, Petroleum Investigations (U. S. Congress, House of Representatives Hearings on H. Res. 290 and H. R. 7273, 76th Cong., 3d Sess., 1940), pt. 3, p. 1241.

TABLE 7

Cumulative Oil Recovery, Reservoir Pressures, Cumulative Decline of Reservoir Pressure, and Gas/Oil Ratios, Buckner Field, Arkansas, to January, 1941[1]

Year and Month	Oil Production, Bbl.		Reservoir Pressure (End of Month) at 6,900 Ft., Subsea, Lb. Per Sq. In	Cumulative Decline of Reservoir Pressure, Lb. Per Sq. In.	Gas/Oil Ratios, Cu. Ft. Per Bbl.
	Monthly	Cumulative			
			[2]3,195		
1938 June	26,708	109,433	3,135	60	234
July	32,278	141,711	3,120	75	227
Aug.	39,289	181,000	3,110	85	256
Sept.	42,001	223,001	3,085	110	240
Oct.	44,794	267,795	3,040	155	224
Nov.	41,942	309,737	3,020	175	216
Dec.	41,752	351,489	3,010	185	212
1939 Jan.	41,516	393,005	2,985	210	198
Feb.	39,637	432,642	2,955	240	201
Mar.	48,583	481,225	2,940	255	204
Apr.	49,954	531,179	2,930	265	192
May	51,161	582,340	2,905	290	195
June	54,805	637,145	2,885	310	252
July	59,443	696,588	2,880	315	227
Aug.	[3]32,378	728,966	2,943	252	220
Sept.	66,532	795,498	2,905	290	210
Oct.	70,421	865,919	2,875	320	224
Nov.	71,446	937,365	2,868	327	217
Dec.	75,222	1,012,587	2,835	360	207
1940 Jan.	75,474	1,088,061	2,793	402	244
Feb.	70,047	1,158,108	2,769	426	231
Mar.	62,150	1,220,258	2,794	401	252
Apr.	62,470	1,282,728	2,776	419	264
May	70,932	1,353,660	2,740	455	270
June	63,270	1,416,930	2,729	466	258
July	70,667	1,487,597	2,725	470	277
Aug.	70,784	1,558,381	2,721	474	277
Sept.	71,216	1,629,597	2,725	470	253
Oct.	60,595	1,690,192	2,731	464	242
Nov.	60,010	1,750,202	2,732	463	239
Dec.	65,751	1,815,953	2,732	463	239

[1] Data furnished by the Arkansas Oil and Gas Commission.
[2] Original reservoir pressure.
[3] Field closed in from August 17 to September 1.

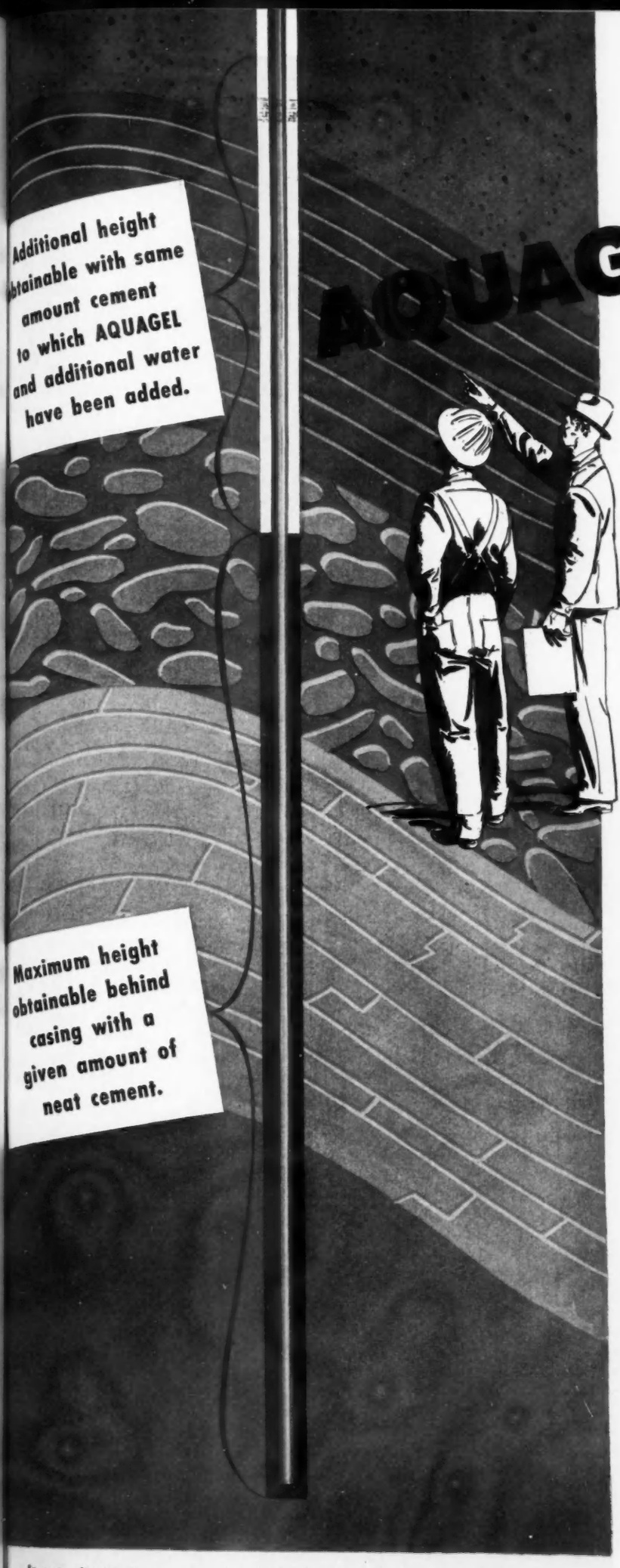
Buckner Field

Monthly observations of reservoir pressures, oil production, and gas-oil ratios for the Buckner field, Arkansas, from October, 1937, through 1940 are given in Table 7.

The results of the writer's study of the pressure decline-oil recovery history of the Buckner field are of interest because the oil, unlike that in reservoirs previously discussed, is undersaturated with gas, and only liquid (oil) moves through the reservoir rocks to wells.

Graph A (Figure 3) is a logarithmic plot of monthly observations of cumulative decline of reservoir pressure and cumulative recovery of oil in the Buckner field. The best representative lines drawn through the plotted observations (for the first 1,400,000 barrels of oil recovered) are parallel straight lines having slope angles of +45°. (The lines are offset to the right because during cer-

AQUAGEL SAVES CEMENT


Additional height obtainable with same amount cement to which AQUAGEL and additional water have been added.
Maximum height obtainable behind casing with a given amount of neat cement.

In many districts there is a scarcity of oil well cement. The amount available can be extended to lessen this shortage by the addition of AQUAGEL.

The addition of AQUAGEL to cement reduces the number of sacks of cement required to set casing by as much as 25% to 33⅓%. Many casing jobs requiring 1400 sacks of cement with about a 5-gallon-per-sack water ratio have been cemented with only 1000 sacks of cement with 5% to 6% AQUAGEL and an 8½-gallon-per-sack water ratio. This reduction in the amount of cement necessary makes AQUAGEL-cement highly economical.

AQUAGEL-cement assures a better bond between casing and hole because it sets without shrinkage—in the same volume as poured. Although less cement is thus required, adequate strength is obtained with a large margin of safety to secure satisfactory results.

To save cement and get a better cement job, always use AQUAGEL. It provides advantages which are invaluable in cementing casing.

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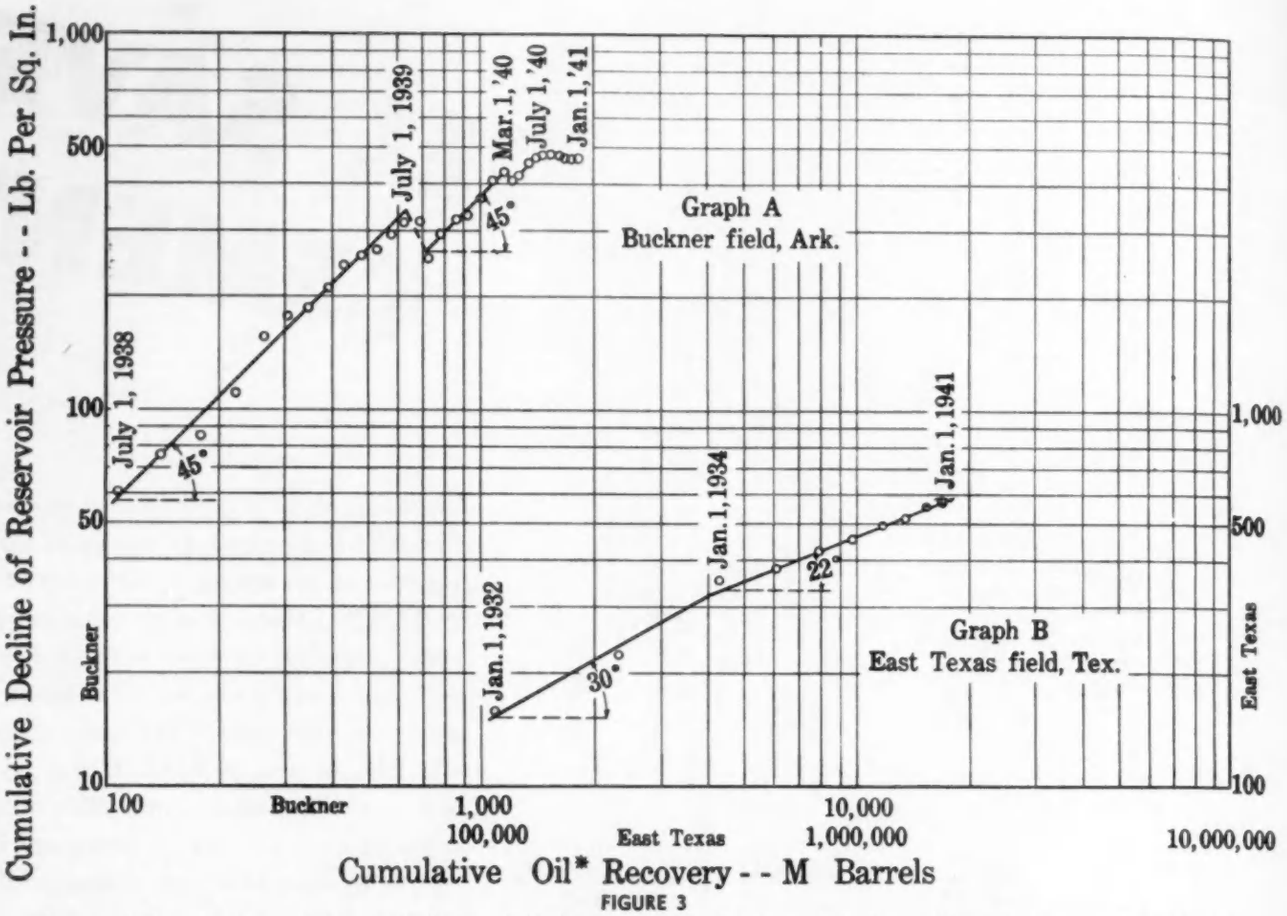


FIGURE 3

Pressure decline-oil recovery relations in the Buckner field, Arkansas, and the East Texas field, Texas. (*For East Texas, oil plus net water).

tain months the gradually increasing rate of oil production was arrested temporarily or the oil-production rate declined below those of the preceding months, causing reservoir pressures to increase.)

Water under high head underlies the oil in the Buckner reservoir system and moves into the oil-bearing formation as oil is withdrawn from the reservoir. Inasmuch as the oil in the reservoir is undersaturated with gas and equal quantities of oil were recovered (except for short intervals of time when reservoir pressure increased) for equal amounts of pressure decline, as is evident from the slope angles of +45° for the relation on a logarithmic chart between cumulative decline of reservoir pressure and cumulative oil recovery, declining pressures in the reservoir must be the result of a declining head of water in the extraneous part of the reservoir system. On the other hand, the fact that reservoir pressures increased when the field was shut in during August, 1939, and during other months when production rates were curtailed to a greater degree than in preceding and following months, indicates that the Buckner is a water-drive reservoir in which pressures depend entirely on the head of water in the extraneous part of the reservoir system.

After the pressure in the reservoir had declined 466 pounds per square inch by July 1, 1940, after slightly more than 1,400,000 barrels of oil had been withdrawn, the rate of inflow of water into the extraneous part of the reservoir system seems to have balanced approximately the rate of outflow of oil from the reservoir. This view is supported by subsequent reservoir-pressure observations, which showed virtually no decline, and the slope angle of the relationship on a logarithmic chart between cumulative decline of reservoir pressure and cumulative oil recovery (July 1, 1940, to January 1, 1941) is approximately 0°.

The Buckner reservoir system can be likened to a large U-tube with oil in one leg and water in the other. If only a small quantity of water is allowed to enter the water leg of the U-tube, whereas a larger quantity of oil is withdrawn from the oil leg, pressures at the bend of the tube will decline in direct relation to the decline of the head of water in the water leg. On the other hand, if the volume of water entering the U-tube balances the volume of oil withdrawn, the pressure at the bend of the tube will not change, and the relation between pressure decline and oil recovery will be similar to that in the Buckner reservoir since July 1, 1940, and definable on a logarithmic chart by a line parallel to the x or cumulative oil-recovery axis.

East Texas Field

Statistical information on the quantities of oil and water produced in the East Texas field, quantity of water returned to the producing sand, and reservoir pressures for 1931 through 1940 are given in Table 8.

A plot of the annual observations of cumulative decline of reservoir pressure and cumulative recovery of oil and net water for the East Texas field (see graph B, Figure 3) shows that the relation between them can be represented on a logarithmic chart by two interconnecting straight lines having respective slope angles of +30° and +22°.

The oil in the East Texas reservoir (like that in the Buckner pool discussed in the previous section of this report) is undersaturated with gas at reservoir pressure and temperature. It would be expected, therefore, if the oil moved through the reservoir sands to wells because of energy furnished by a mobile column of water in the extraneous part of the reservoir system, that the slope

angles would be either +45° or 0°, depending on whether the head of water declined or remained constant as oil was produced. How, then, can the slope angles of +30° and +22° for the East Texas reservoir be explained?

The outcrop of the East Texas reservoir is west of Dallas, about 125 miles west of the oil reservoir. Meteoric water enters the outcrop, but calculations made by various engineers indicate that the volume influx of water at the outcrop does not equal the volume outflow of oil (and net water) from the underlying oil reservoir. If the water in the extraneous part of the reservoir system moved as a body into the oil reservoir, volume influx of water (at the outcrop) at a lesser rate than volume efflux of oil (and net water) from the reservoir might explain the declining pressures observed in the East Texas reservoir. Under such conditions, for an undersaturated oil, however, the relation between the cumulative decline of reservoir pressure and cumulative recovery of oil (and net water) on a logarithmic chart would have a slope angle of +45° if the head of water in the extraneous part of the reservoir system declined as oil (and net water) was produced. As the slope angles for the East Texas reservoir are considerably less than +45°, it is apparent that their size cannot be explained by considering the oil-motivating agent to be a mobile column of water behind the oil.

At one time, compaction of the reservoir formation was considered by some engineers as probably having been responsible for the retardation of pressure decline in the East Texas reservoir. In 1935, Hudnall[14] suggested that the retarded rate of decline of pressures in the East Texas reservoir may have been due to compressibility of the reservoir sands, because he believed sands compact as oil and gas are released from them, and compression reduces their permeability and hence the velocity of flow of oil and gas through them. However, recent experiments performed by Carpenter and Spencer[15] do not suggest that the extraneous natural force in the East Texas reservoir is the result of the weight of the overlying rocks and compressibility of the oil-producing sands. These experimentors deduced from their studies that the compressibility of oil-bearing sandstones "is not of sufficient magnitude to have an appreciable influence on estimates of reservoir content and ultimate recovery or on fluid and energy relationships of petroleum reservoirs."

Schilthuis and Hurst[16] reported in 1934 that the data on the East Texas field indicate clearly that water drive or water encroachment is by far the most important agency in maintaining the reservoir pressure or in producing the oil [and] it appears that the water moves into the field by virtue of its own expansion upon reduction of pressure, and not * * * by flowing through the entire formation from its surface outcrop to the field.

Additional data acquired after 1934 made it possible for Buckley[17] in 1938 to evaluate the strength of the water drive [in the East Texas field] to a degree of precision which permits a reliable calculation of the reservoir behavior under any probable condition of operation.

When discussing the mechanism of the East Texas water drive, Buckley wrote:

Subsurface samples of the reservoir fluid have shown that the East Texas oil was originally undersaturated with gas, the saturation pressure averaging 740 pounds per square inch gauge at the reservoir temperature.[18] The oil originally existed, however, at a pressure of approximately 1625 pounds per square inch, measured at 3300 feet subsea. This excess pressure was hydrostatic, transmitted to the oil by water from the Woodbine sand, the magnitude of the pressure being derived from the difference in elevation between the Woodbine outcrop and the oil reservoir.

Due to the slight compressibility of the undersaturated oil (0.1 percent per 100 pounds per square inch), it would have been impossible for expansion of the oil in place to have maintained the reservoir pressure above the saturation pressure for longer than the first few months of operation. The production of large quantities of oil with only slight decline in pressure indicated, therefore, the existence of an effective source of energy outside of the oil itself. The only tenable explanation was that the oil was being maintained in a compressed state by the same source from which the pressure was originally derived, that is the influx of water from the body of the Woodbine sand into the original confines of the oil reservoir.

* * * In brief, the water moves into the (East Texas) field in the following manner: The water in the Woodbine sand was originally compressed just as the oil in the reservoir was compressed. Although water has a smaller compressibility than has the undersaturated oil, the tremendous quantity of water present is able to expand appreciably with slight pressure reduction. The pressure decline incident to the withdrawal of oil from the reservoir is transmitted to the water outside of the reservoir, causing it to expand and fill the space vacated by the oil. As the expansion, and consequently the volume of water entering the reservoir, is proportional to the pressure decline, it is obvious that a definite relation must exist between the pressure and the rate of water influx. Since this water merely replaces the oil, the same relation must link the reservoir pressure with fluid withdrawals. The pressure decline transmitted to the water nearest to the field is in turn transmitted through the water progressively farther out in the sand west of the field, the course of the pressure gradients depending upon the time which they have had to be established.

Apparently, then, as explained by Schilthuis and Hurst[19] and Buckley,[20] the expansion of the water[21] in the extraneous part of the East Texas reservoir caused the water to move into the oil reservoir.

Graph B (Figure 3) shows that the expansion of the water in the East Texas reservoir seems to have the same effect on the slope of the logarithmic relation between cumulative decline of reservoir pressure and cumulative oil recovery as has gas expansion; or that caused by a combination of gas expansion and water drive when oil saturated with gas moves through the reservoir sands and porous rocks to wells. As for reservoirs in which a combination of gas expansion and water drive is the oil-motivating agency, reservoirs in which the oil is undersaturated with gas, and water expansion alone furnishes the energy to move oil to the wells, a decrease in the slope angle indicates an increase in the efficiency of utilization of reservoir energy. This can be shown by a study of the relative quantities of oil recovered per unit decline of reservoir pressure for different slope angles.

Production of oil in the East Texas field reached a peak in 1933, when almost 205,000,000 barrels of oil were recovered. During that year the average reservoir pressure declined from 1400 to 1272 pounds per square inch, and 1,600,000 barrels of oil was produced per 1-pound-per-square-inch decline of reservoir pressure. During 1934, 181,-

[14] Hudnall, J. A., Address delivered at a meeting of the American Association of Petroleum Geologists, Dallas, Texas, March 1934.

[15] Carpenter, Charles B., and Spencer, Geo. R., Measurements of Compressibility of Consolidated Oil-Bearing Sandstones: Bureau of Mines Rept. of Investigations 3540, 1940, 20 pp.

[16] Schilthuis, Ralph J., and Hurst, William, Variation in Reservoir Pressure in the East Texas Field: Trans. Am. Inst. Min. and Met. Eng., Petrol., Devel. and Technol., 1935, p. 172.

[17] Buckley, Stuart E., The Pressure-Production Relationship in the East Texas Field: Oil Weekly, vol. 89, No. 5, April 11, 1938, p. 19.

[18] Lindsly, Ben E., A Study of Bottom-Hole Samples of East Texas Oil: Bureau of Mines Rept. of Investigations 3212, 1933, 22 pp.

[19] Schilthuis, Ralph J., and Hurst, William, Work cited in footnote 16.

[20] Buckley, Stuart E., Work cited in footnote 17.

[21] Muskat (see Muskat, M., The Flow of Homogeneous Fluids Through Porous Media: McGraw-Hill Book Co., Inc., New York, 1937, p. 652) shows, by means of a graph, that pressures in the water reservoir in the Woodbine sand adjacent to the East Texas field as of July 1, 1934, has been appreciably affected only within a radius of 20 miles from the field and concludes that beyond this radius the original pressure of 1620 pounds per square inch at 3300 feet subsea may be considered, for practical purposes, as unaffected.

TABLE 8

Annual Statistics of Oil and Water Production, Water Returned to the Reservoir, and Reservoir Pressures in the East Texas Field, Texas, 1931-40, Inclusive

YEAR	Production, M Bbl.		Water Returned to Reservoir,[2] M Bbl.	Oil and Net Water Produced, M Bbl.	Cumulative Oil and Net Water Produced, M Bbl.	Reservoir Pressures (End of Year) at 3,300 Feet Subsea,[2] Lb. Per Sq. In.	Cumulative Decline of Reservoir Pressure, Lb. Per Sq. In.
	Oil[1]	Water[2]					
1	2	3	4	5	6	7	8
						[3]1,620	
1931	109,561	.....	.....	109,561	109,561	[4]1,465	155
1932	121,449	.....	.....	121,449	231,010	[4]1,400	220
1933	204,954	.....	.....	204,954	435,964	1,272	348
1934	181,540	.....	.....	181,540	617,504	1,247	373
1935	176,859	[5]4,750	.....	181,609	799,113	1,202	418
1936	167,512	11,548	.....	179,060	978,173	1,176	444
1937	170,673	23,467	.....	194,140	1,172,313	1,124	496
1938	152,116	30,819	223	182,712	1,355,025	1,108	512
1939	144,600	40,302	2,251	182,651	1,522,691	1,063	557
1940	[6]141,000	44,925	10,966	174,959	1,697,650	1,053	567

[1] Data in column 2 are from annual editions of Bureau of Mines Minerals Yearbook.
[2] Unless otherwise noted, data in column 3, 4, and 7 are reflected in data furnished by the Railroad Commission of Texas.
[3] Original reservoir pressure.
[4] Estimated from figure 1 accompanying "Variations in Reservoir Pressure in the East Texas Field" by Ralph J. Schilthuis and William Hurst. Trans. Am. Inst. Min. and Met. Eng., Petrol. Devel. and Technol., 1935, p. 165.
[5] Estimated from chart accompanying Salt-Water Injection in East Texas at Important Stages, by George Weber: Oil and Gas Jour., Mar. 13, 1941, p. 36.
[6] Preliminary data subject to revision.

540,000 barrels of oil were produced, but during that year reservoir pessures declined only 25 pounds per square inch —a recovery of 7,260,000 barrels of oil per 1-pound-per-square-inch decline of pressure. The increase in efficiency of utilization of reservoir energy is evident from the smaller slope angle for 1935 than for 1933. As the slope angle did not change after January 1, 1934, continually increasing quantities of oil (oil and net water) are indicated as having been recovered per unit of pressure decline, and in 1940, when the slope angle still was +22°, 17,942,800 barrels of oil (and net water) were produced from the reservoir per 1-pound-per-square-inch decline of reservoir pressure—more than 11 times as much as during 1933, when the slope angle was +30°.

The fact that the slope angle of the relation between cumulative decline of reservoir pressure and cumulative recovery of oil (and net water) on a logarithmic chart continued (to January 1, 1941) to be +22° indicates that the expansion of the water in the extraneous part of the reservoir system on that date still was responsible for the production of oil from the East Texas reservoir. The +22° slope angle indicates also that the pressure gradient in the oil reservoir and for some distance out in the water reservoir had not yet reached the physical limits of the reservoir system.

Concluding Statement

The graphic method for exhibiting reservoir - pressure and oil production data discussed in this report, where the cumulative decline of reservoir pressure (in pounds per square inch) is plotted as ordinates on a logarithmic chart against cumulative oil recovery[22] (in barrels) as abscissas, appears to have advantages in analyzing pressure-production data on petroleum reservoirs. By this method the relation between cumulative decline of reservoir pressure and cumulative recovery can be represented on a logarithmic chart by straight lines for large increments of liquid recovered. For some reservoirs one or two and for most reservoirs not more than three or four interconnecting straight lines will exhibit the pressure decline-oil recovery relations for their entire producing lives. The lines have different slopes, and the slope angles, when studied in conjunction with the physical characteristics of the oil and the type of reservoir, are shown in the report to reveal whether the source of energy driving oil through the sands and porous rocks to wells is the result of gas expansion, a combination of gas expansion and water drive, or solely a natural water drive.

As a change in the rate of oil production (or in gas-oil ratios for water-drive reservoirs in which the source of energy is the expansion of gas or a combination of gas expansion and water drive) affects the efficiency of utilization of reservoir energy and is reflected in the size of the slope angle, the relative efficincy of oil-producing methods in a given reservoir can be determined by comparing the slope angles before and after a change in operating procedure. It the slope angle, after a change in field operating methods, is smaller than before the rates of oil withdrawal or gas-oil ratios were altered, the efficiency of utilization of reservoir energy must have increased, as the smaller slope angle indicates the recovery of a larger quantity of oil per unit decline of reservoir pressure.

It does not follow necessarily, because decreasing slope angles mean increasing efficiency of utilization of reservoir energy under certain conditions, that a slope angle of 0° indicates maximum efficiency of recovery of oil from a reservoir. A change in the relation between cumulative decline of reservoir pressure and cumulative oil recovery from one exhibiting a positive slope angle on a logarithmic chart to one of 0° only indicates that the expansion of gas in the reservoir has been replaced by a natural water drive. In general, however, a water drive is a more efficient oil-motivating agent than gas expansion, and a reservoir in which a water drive has operated throughout its producing life usually will yield more oil ultimately than if part of the oil had been recovered as a result of gas expansion. Nevertheless, in all reservoirs in which the oil moves through the sands and rocks as a result of a water drive, the rate of advance of the water is a factor in the efficiency of oil recovery. Although a fairly rapid rate of water movement may permit the recovery of more oil than an exceedingly slow rate, edgewater will "finger" into an oil reservoir, if the rate of encroachment is too rapid, and bypass oil that might have been recovered if the rate of water movement had been slower.

The logarithmic relationship between cumulative decline of reservoir pressure and cumulative recovery of oil (and net water) for the East Texas reservoir is unique for reservoirs in which the oil is undersaturated with gas. Whereas the slope angle for reservoirs yielding oil undersaturated with gas in which pressures are declining as oil is withdrawn should be approximately +45°, for the early producing life of the East Texas reservoir (to January 1, 1934) the slope angle on a logarithmic chart of the relation between cumulative decline of reservoir pressure and cumulative oil (and net water) recovery is +30° and thereafter (to January 1, 1941) +22°. For most reservoirs positive slope angles indicate that an expansive force operates to move some or all of the oil through the reservoir sands to wells; and because there is no material expansion of gas in the East Texas reservoir, the oil-motivating agency must be the expansion of water in the extraneous part of the reservoir system, which accords with accepted facts.

The writer believes that much information of value to petroleum engineers will be gained from studies of reservoir behavior based upon cumulative reservoir pressure decline-oil recovery relationships. Possibilities, other than those discussed, of interpretation and application of the method may occur to the reader that have not been developed in this report, which has been written mainly for the purpose of outlining a general procedure for obtaining a series of straight-line relationships that may help to interpret reservoir behavior.

[22] In the East Texas field, the cumulative oil and net water recovery is considered.

Sturdy Protecting Housing Prolongs Boiler Control Life

To PROTECT delicate steam and fuel control units to a degree that they will continue to provide the necessary sensitive regulation, which is especially important now that replacement parts are increasingly difficult to obtain, one drilling organization took a relatively small amount of steel plate and erected a permanent container for the controls.

Since freezing under severe weather can also derange the operation of the control, it was decided to include in the protective unit means for maintaining temperatures above the critical. The box or chest in which all the equipment was permanently mounted was welded from tank steel, superposed on and forming an integral part of the skid structure. A heavy lid, formed with flange to afford any desired degree of sealing, was hinged at the back, a truss rod at this point providing means for hooking on the winch line for moving.

The unitized boiler steam pressure controller, fuel gas pressure regulator and automatic stack blower control were set up in a unit to which was added a small coil type steam heater.

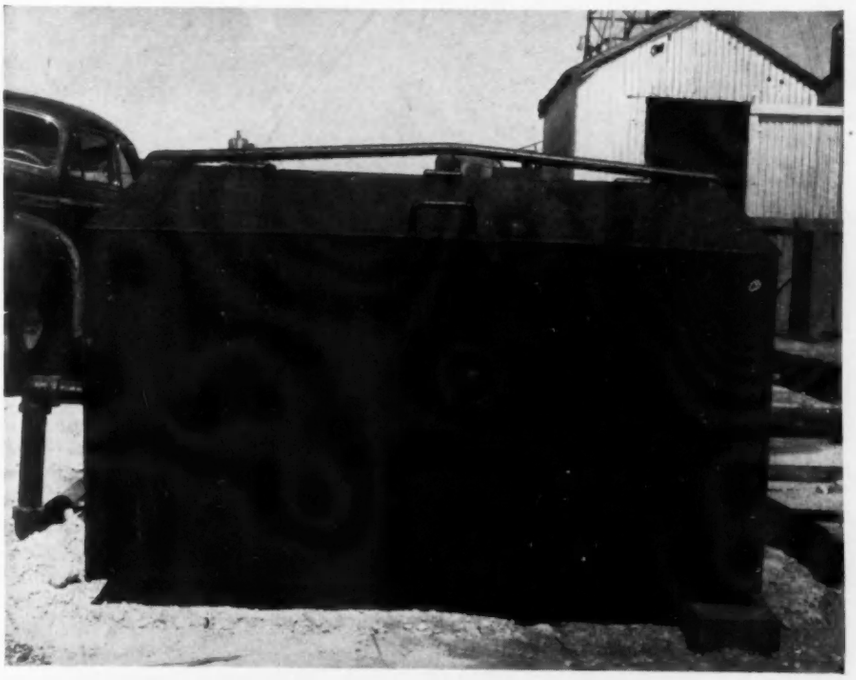
Connections for all these various leads were taken through the side wall of the box or chest, and, provided with unions at these points, permitted the entire unit to be disconnected and handled without danger of damage to any of the accurately set control units.

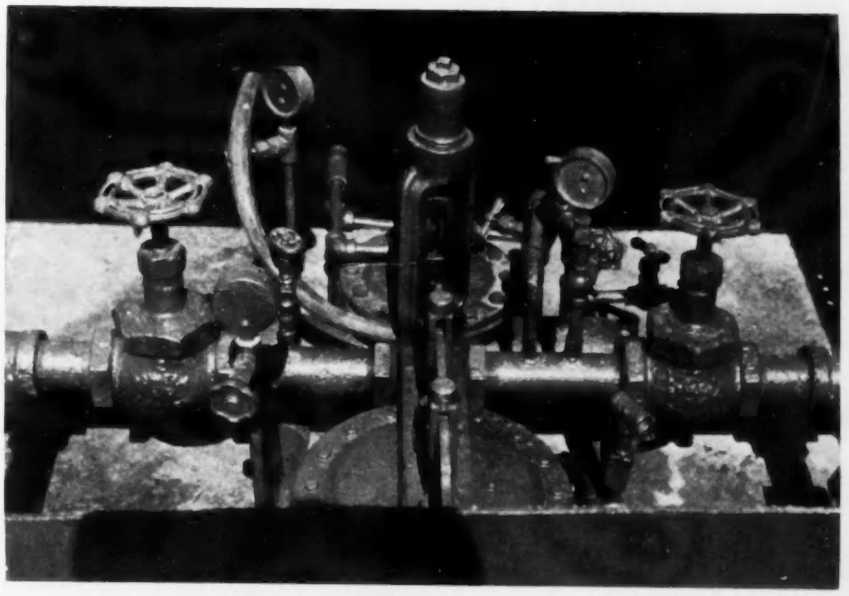
By regulating the flow of steam through the heater coil, arranged to exhaust to atmosphere, it is possible to maintain any desired temperature within the box, and even to provide sufficient heat to maintain the fuel gas regulation unit at operating temperature despite the tendency to form hydrates at the reducing valve.

Due to the possibility of maintaining any desired temperature of the enclosed units, it is sufficient to warm everything up well just prior to a move to insure that all controls will be functioning when tied in to the next set-up, when a move is made between adjacent locations. On longer moves, by blowing the steam coil wide open before cutting off, the units may all be provided with sufficient stored heat to insure their being operable on a longer move, if the outside of the case be covered with one or more tarpaulins to prevent excessive radiation through the steel chest walls.

Protection of the operating control units within a closed box instead of allowing them to lie exposed on the boiler-feed-pump skid, is also found to insure more uniform boiler operation, due to the set-up checking the tendency of some of the crew to experiment with a setting which has already been tested and found satisfactory for the conditions at the rig.

Since none of the units enclosed within the box requires cooling or the provision of auxiliary air, normal operating characteristics are unchanged by the unitizing and complete enclosure of the control units.





The steel box, equipped with close-fitting lid and heavy bar for attaching winch line hook, completely encloses the control units and not only affords protection against accident, but enables the temperature to be regulated to prevent freezing. Looking down into the box (below), the various elements may be seen, closely ranked, but with ample space for replacement or adjustment without necessitating contact with others of the set-up. The steam coil provides temperature regulation to prevent hydrate formation in fuel gas control and prevent concealing of fluid in pressure leads.

Boyd

[*Continued from page 13*]

into whose skill has gone years of training. The manpower problem is one of the most serious now confronting the industry, and some solution must be found without delay.

"Specifically-earmarked price increases have offset some of our increased costs because of transportation changes, but the refining branch of the industry particularly is incurring unique war costs that must be recognized soon by the government. The burden of manufacturing more lower-priced and less higher-priced products in a frozen economy is attacking the solvency of many of the smaller units of the industry, and actually is threatening their ability to produce.

"New oil reserves are needed at once, and studies of the Petroleum Industry War Council and others are being made now to determine what incentives ought to be granted to encourage new discoveries of oil.

"Crude oil production, estimated at about 1,385,000,000 barrels for the year, was slightly under the all-time record of 1,404,000,000 barrels in 1941, and the approximately 20,000 well completions last year were only 60 percent of the 1941 total. Stocks of crude oil at the end of the year reached the lowest point in 20 years.

"For 1943, if we can produce it and transport the products, there should be a substantial increase in crude oil production. To meet even the rationed demand would require a rise of more than 400,000 barrels a day by the end of the year, compared with the same period of 1942.

"Total production of motor fuel, kerosine, and lubricants dropped from the 1941 records, but the output of light and heavy fuel oils reached new all-time highs. Inventories of all major products except lubricants declined at the end of the year to levels substantially below the 1941 year-end stocks.

"Indicative of the low level of petroleum prices is the fact that the Bureau of Labor statistics' index of wholesale prices for petroleum products rose only from 52.2 in 1939 to 59.8 last year, while for all commodities the index jumped from 77.1 to 98.8."

☆

ICKES SAYS: Military secrecy is so closely guarded that even PAW is unable to get detailed information for capable operation, Administrator Ickes told a press conference December 24.

Ickes had little to say about the Eastern situation, declaring that he could not give out details which reporters asked regarding consumption, but expressed the hope that the cut in value of "B" and "C" coupons will tide the East over. OPA, he said, apparently thinks it will.

Application to WPB for the second long-distance pipe line has as yet had no results, but the first leg of the big-inch is within a few miles of its goal and the equipment situation has been straightened out. Of the 48 valves needed to get the line in operation, nine have been installed, six are in transit, eight will arrive before the end of the year and the remainder will show up at the rate of six a week, making it possible to put the line to work by February 1.

Railroad deliveries of oil into the Atlantic seacoast area increased during the week ended December 19, averaging 744,023 barrels daily against 736,099 barrels the preceding week.

☆

PIPE LINE: Construction of the second leg of the big-inch pipe line got under way December 21 on the mainline section west of Phoenixville Junction, Pennsylvania.

"The first of the veteran pipe line crews on whom we are counting for record construction of the eastward extension welded the first pipe this morning," Administrator Ickes announced.

"A second and third crew are expected to start work within the next few days, and by early January work should be going full blast on all 17 contract sections."

Deputy Administrator Davies disclosed that more than 160 miles of the 857 miles of pipe needed has already been delivered to distribution points along the right of way. Seventeen crews are to fight winter to bring the line to the starving East, but at best it will be mid-summer before any oil is delivered direct from Texas to New York or Philadelphia and even then, Davies admitted, the extent to which the line will alleviate the shortage will depend largely on the development of Army-Navy demands for off-shore shipment to the theatres of war.

☆

CONTRACTS: Contracts for the operation of 28 aviation gasoline plants to be built by the Defense Plant Corporation at a cost of $189,662,963 have been entered into by Defense Supplies Corporation, it is disclosed in the latest report of the Reconstruction Finance Corporation on its war activities.

The contracts call for the operation of one plant, each, by the following companies:

J. S. Abercrombie and Harrison Oil Company, American Cyanamid & Chemical Corporation, Anderson-Prichard Refining Corporation, Ashland Oil & Refining Company, Associated Refineries, Inc., The Bay Petroleum Corporation, Charter Refining Company, Chicago Chemical Company, Cities Service Refining Corporation, Continental Oil Company, Crown Central Petroleum Corporation, Diakel Corporation, Eastern States Petroleum Co., Inc., Frontier Refining Company, Great Southern Corporation, Houdry Process Corporation, Hohawk Petroleum Corporation, National Refining Company, The Pennzoil Company, Premier Oil Refining Company of Texas, The Pure Oil Company, Republic Oil Refining Company, Root Petroleum Company, Southport Petroleum Company of Delaware, Standard Oil Company of Louisiana, Terminal Refining Corporation, Utah Oil Refining Company and Wilshire Oil Company, Inc.

Contracts for the operation of 67 synthetic rubber plants also have been made with the following companies, to operate one plant, each, except as specified in parentheses:

American Car & Foundry Company, Atlas Oil Company of Louisiana, Barium Reduction Corporation, Buffalo Electro Chemical Company, Carbide & Carbon Chemicals Corporation (4), Cities Service Oil Company, Consolidated Oil Corporation, Copolymer Corporation, Crown Central Petroleum Company, Davison Chemical Company (2), Dow Chemical Company (4), Eastern States Petroleum Company, E. I. du Pont de Nemours & Company (2), The Ethyl Corporation, Filtros, Inc., Firestone Tire & Rubber Company (3), General Synthetic Company, B. F. Goodrich Company (4), Goodyear Tire & Rubber Company (4), Hancock Oil Company of California, Humble Oil & Refining Company (2), Koppers United Company (2), Magnolia Petroleum Company, Monsanto Chemical Company, National Synthetic Rubber Corporation, Neches Butane Products Company, Pacific Gas & Electric Company, Pan American Petroleum Company, Phillips Petroleum Company, Publicker Commercial Alcohol Company, Quaker Oats Company, Q. O. Chemical Company, Shell Chemical Company, Sinclair Refining Company, Sinclair Rubber, Inc., Southern California Gas Company, Southport Petroleum Company, Standard Oil Company of California, Standard Oil Company (Indiana), Standard Oil Company of Louisiana (3), Sun Oil Company, The Thiokol Corporation, United States Rubber Company (3), Ugite Sales Corporation and Westvaco Chlorine Products Corporation.

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LIP
PROTECTORS

Ickes Reports on Achievements

[*Continued from page 13*]

materials of rubber from petroleum and natural gas products, and by recommending new production and manufacturing methods for consideration of the rubber director.

Transportation Revamped

2. Supervised and directed a major revolution in petroleum transportation involving the substitution of overland facilities for the normal method of hauling petroleum and its products by ocean tank ship. Pipe lines, tank cars, barges and trucks have been mobilized into one vast overland oil transportation system.

The entire pipe-line network of the interior United States was surveyed and a construction program put under way which, in effect, will organize this network into a single system designed to move the maximum volume of oil the maximum distance north and east toward the Atlantic Seaboard . . . This program involves the taking up and relocating of 1700 miles of existing pipe lines . . . nearly 2400 miles of new lines are being laid, including 1388 miles of 24-inch pipe from Texas to the East Coast . . . The direction in which oil flows through 2800 miles of other lines is being reversed . . . Countless installations of pipe line equipment and storage facilities were undertaken.

Encouraged and aided the vastly-increased use of railroad tank cars to the point where East Coast movement has exceeded 850,000 barrels daily. This is more than 800 times the volume normally moved in pre-war days . . . Because the 70,000 tank cars now engaged in this extraordinary service had to be drawn largely from other sections of the country, ways were devised to enable those sections to use more efficiently the facilities left for them.

To facilitate the handling of shipments brought in on through - train schedules from the West. OPC arranged for and directed the far-reaching measures under which the industry is pooling its terminal facilities and products on the East Coast . . . This involved establishing standard specifications for the principal petroleum products in cooperation with the industry . . . Consent of the industry was obtained before action was ordered, inasmuch as the pooling arrangement involved submerging individual company identities and curbing free-play of competition.

3. Activities relating to the discovery, development, and production of crude petroleum and condensates were coordinated to the end that these products could be most efficiently produced at required levels for howsoever long the war may last in the face of a decline in the discovery rate of new reserves.

Development of known petroleum reserves with a minimum expenditure of critical materials was provided for, effecting savings of enough steel to make half a million 2-ton "block buster" bombs.

Production Efforts

The more efficient participation by the various oil-producing states in the job of producing oil for war was arranged by certifying monthly production rates to each of the several states, based upon their ability to sustain such production . . . Cooperated with the Tariff Commission and Office of Price Administration in organizing a survey of the costs of producing crude oil, for consideration in connection with price adjustments . . . Arranged with the Bureau of Mines for the establishment of a laboratory in Pennsylvania to study and foster secondary-recovery methods in the Eastern production areas as a means of augmenting the nation's petroleum reserves . . . Undertook and completed the complicated task of forecasting the productive capacities of the thousands of oil wells and fields of the United States in order to determine the extent of development required to insure a continuous and adequate supply of crude oil . . . To meet the critical materials shortage, provided for a nation-wide survey of oil-field facilities which can be reclaimed for superior war uses . . . Encouraged the more effective and efficient distribution of the production quota for California among the several pools and wells in that state . . . Fostered, particularly in Texas, the maximum efficient production of aviation-grade crude oil so as to assure an adequate supply of raw materials to plants making aviation gasoline . . . Processed more than 2600 applications for exceptions to the oil-well-spacing requirements of Conservation Order M-68.

Dealt with various problems involved in the production of natural gas, the production and manufacture of natural gasoline, and the associated hydrocarbons used in the manufacture of war products . . . initiated action whereby well-spacing requirements were relaxed in the Appalachian area, Eastern Kansas, Northeastern Oklahoma, and Missouri to help alleviate critical gas shortages . . . Worked with State of Arkansas to help alumina and aluminum plants in that state, to obtain gas in quantities needed to turn out war products . . . In cooperation with other federal agencies and with the California Railroad Commission, arranged for the use of the Playa Del Rey oil field as a vast gas storage reservoir to store 2,000,000,000 cubic feet of natural gas.

Reported upon and obtained priorities on a project for the maintenance of reservoir pressure in the East Texas oil field by the reinjection of salt water . . . Surveyed petroleum reserves in the Illinois basin area and Western Kansas . . . Prepared estimates of gas production and disposal in 700 Texas oil fields . . . Surveyed possibilities of using oil sands at Vernal, Utah . . . Surveyed the blowing of natural gas in the California fields as a basis for conservation of gas in that state.

Marketing Programs

4. Formulated and directed marketing programs to insure the efficient distribution and local availability of petroleum products for industrial and war needs, as well as essential civilian uses . . . Prosecuted a program for the conversion of industrial oil-burning facilities from the use of oil to the use of coal, effecting a saving of more than 27,000,000 barrels of heavy fuel oils in the Eastern States alone, by mid-November . . . Developed plans for the relocation or salvage of petroleum marketing and distribution equipment, and for the joint use of marketing facilities and equipment.

5. Unitization and repressuring agreements covering 5 oil and gas fields on federal lands approved . . . Thirty producing wells were completed under federal oil and gas leases and 3,468,000 barrels were added to estimated recoverable oil reserves on federal lands . . . Examination work pushed on borings on Western and Canadian oil lands . . . Reports were published on gas fields.

6. Leases issued covering approximately 85,000 acres of known producing structures . . . Other leases issued for 250,000 acres for prospecting potential oil lands.

PRICES: To enable gasoline retailers to remain in business despite curtailment of sales as a result of rationing, OPA on December 24 established a minimum operating margin of three cents for filling stations throughout the country.

OPA's action merely extended to the entire nation a margin which for some time has been in effect in the Eastern states.

HOW TO GET MORE SERVICE FROM PUMP RODS AND SHAFTS...

PART 1—

Re-conditioning by machining and re-finishing

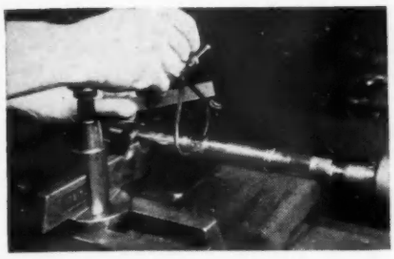
Worn pump rods, shafts and wearing sleeves are readily renewed by machining and refinishing, as described below. Usually, a light cut of less than 3/64 in. is sufficient to clean up the worn section.

However, one precaution must be observed: If too much metal must be removed the shaft may be unduly weakened. Therefore, if a shaft shows evidence of "whip" or a reciprocating pump rod tends to "bow" on pressure stroke, the pump manufacturer should be consulted. He will advise whether shaft needs building up before machining.

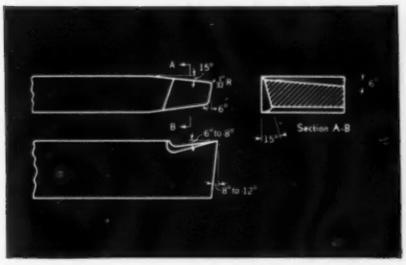
Methods for accomplishing the latter will be outlined in Part II of this subject.

Shafts and rods of Monel or "K" Monel can be reconditioned as described. Their high mechanical properties provide an extra margin of strength, rigidity, and toughness above the normal requirements of actual service.

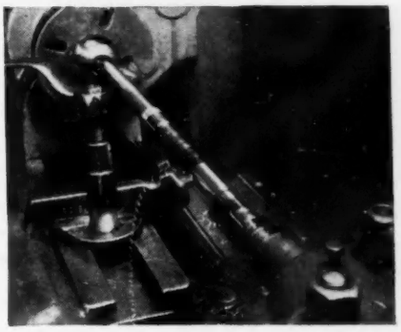
THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET NEW YORK, N. Y.



1. Set up shaft or rod rigidly between centers of engine lathe. Support with a steady-rest, if necessary, to prevent chatter. Measure diameter of worn section with calipers or a point micrometer to determine amount of metal to be removed.



2. No special cutting tool needed — high speed tool preferable, but plain carbon steel satisfactory for this limited amount of machining. In machining Monel or "K" Monel tool should be ground as in sketch. Either a forged lathe tool, or a commercial tool bit (3/8-inch or 1/4-inch) may be used.



3. Take rough and finishing cut leaving enough metal for filing and lapping to final size. No lubricant needed, machining should be done dry. When refinishing rods, length of taper on steam end can be reduced to suit refinishing dimension, but original length of taper on the liquid end should be retained to support bronze pistons. For machining Monel, a speed of 55-60 ft. per min. with .005 in. feed can be used; for "K" Monel, a speed of 35 ft. per min. with .005 in. feed.

4. File machined surface with light pressure, using single cut, smooth file. File should be kept clean, "balled filings" avoided by chalking. A shaft or rod should be filed in direction in which it operates. A shaft should be filed as it revolves in the lathe; a reciprocating rod should be draw-filed lengthwise, turning shaft by hand as filing progresses.

5. Lap filed surface with No. 0 then No. 00 emery cloth. Shaft or rod should be lapped in the direction it operates. The cloth may be held with *half-round* wooden block. Only use emery cloth as long as a clean metal surface results. Cloth should not burnish.

6. ***Before re-installing***

(*a*) Carefully clean finished surface to remove any particles of emery.

(*b*) Check need for new glands, bushings or followers, and larger size packing to fit smaller diameter of re-conditioned rod or shaft.

(*c*) Correct faulty condition or improper operation which may have caused original wear.

★ ★ ★ ★ ★ **INCO NICKEL ALLOYS** ★ ★ ★ ★ ★

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings

Hopeless East

[*Continued from page 12*]

and South Dakota and Iowa and, Henderson said, PAW has given assurance that the additional 20,000 barrels of oil a day which will be required will be made available.

Stabilization Director James F. Byrnes also took a hand in the matter, and called Ickes, Henderson, Eastman and Davies into conference December 21 and again two days later.

Little developed from the first session of the group, other than a conclusion they could hold out "no hope for any lessening of the restrictions upon the use of gasoline and fuel oil."

Byrnes issued a statement after the meeting, explaining that the group discussed "the entire situation with reference to petroleum products.

"The discussion involved the available supplies, the anticipated demands, the methods of rationing, and the supply available for civilian purposes," he explained.

"The agencies involved have shown a splendid spirit of cooperation in the effort to solve the immediate problem resulting from unanticipated demands for military purposes. It is not expected that for the present there will be any material change in the procedure adopted by the respective agencies.

"The agencies will submit to me in writing suggestions as to various phases of the problem and we will meet Wednesday morning for further discussion. In the meantime steps will be taken by the respective agencies to increase supply and to improve rationing methods. However, in view of increased military demands and the delay in securing critical materials to extend terminal facilities and complete pipe lines and barge construction, the agencies involved hold out no hope for any lessening of the restrictions upon the use of gasoline and fuel oil."

The reports that Byrnes requested will indicate in what respects existing policies and machinery may not be effective, and what remedial action should be taken both for the present and the future.

Fuel Oil

Gasoline was not the OPA's only headache. Fuel oil rationing was bringing howls of anguish from householders in 30 states who found they would have to get along with 50 to 75 percent less oil than last winter.

Dealers protested they would not be able to do business under the rationing system if the mileage restrictions of ODT also were applied. Citizens protested the delays in issuing rations, which in many cases did not come along until the first of the five winter periods had practically expired. Many found that while waiting to find out what they would be allowed they had burned not only their allowable for the first period but also most or all of that for the second. Also bitterly protested was the basis on which rations were figured; throwing away the elaborate formula which it had announced would be followed, the ration boards merely took the square footage of living quarters and multiplied it by a specified amount of oil per foot, without regard to type of construction, age, exposure or anything else.

The first definite action to straighten out the situation was taken by Ickes December 21 in an order controlling the amounts of gasoline and fuel oils which may be withdrawn from East Coast refineries and terminal supply points.

The control was set up in the first order issued by the recently-created Petroleum Administration for War—Petroleum Administrative Order No. 1—and provided that the sum total of gasoline, kerosine and fuel oils taken from suppliers' tanks in the area must be within the limits of the supply which PAW determines will be available during any quota period.

The limits set were at the figures which Ickes on December 18 announced represented the volumes of products which would be available for distribution on the Eastern Seaboard during the remainder of December and the month of January. All told, he figured that during the rest of this year, 365,000 barrels of motor fuel, 184,000 barrels of kerosine, 340,000 barrels of distillate oils and 282,000 barrels of residual oils, a total of 1,171,000 barrels, would be available daily, but in January the figures would drop to 331,000 barrels of motor fuel, 167,000 barrels of kerosine, 338,000 barrels of distillates and 281,000 barrels of residuals, a total of 1,117,000 barrels.

But even as the order was issued, Davies warned that it might be necessary to cut even those slim supplies in the event of "unforeseen and unforeseeable military demand," and said that should such an emergency occur such supplies as remained available would be channeled into essential uses first, and the only civilian supplies would be those indispensable to the public health and safety.

There is a distinct probability that the whole problem will be left for final settlement to the new price administrator. And there was also a possibility that the new head of OPA may find it advisable to clean house, to bring into the organization men who may have a new slant on the problems confronting him.

To give the new administrator a free hand, Henderson's top aides are said to have agreed among themselves to offer their resignations to him, among them Paul M. O'Leary, Cornell professor, in charge of rationing; J. K. Galbraith, in charge of prices; David Ginsburg, general counsel, and Robert Horton, publicity director.

As could be anticipated, the gyrations of OPA brought reactions from many quarters.

Senator Maloney, chairman of a special committee to investigate the gasoline and fuel-oil situation, announced that, despite the fact Congress is not in session, hearings would open January 4 on a "complete study of the nation-wide petroleum situation with the purpose of keeping the nation informed of just what it must expect in the future."

First witnesses will be Henderson, Ickes, Eastman, Rubber Director Jeffers and Maritime Commission Chairman Land.

The House oil subcommittee has not yet been authorized to continue its investigations, but the necessary authority is to be asked as quickly as possible after the convening of the new Congress January 6.

Mexico Treaty

[*Continued from page 12*]

Imports within the reduced-tax quota in the first nine months in 1942 from Venezuela and the Netherlands possessions were very much less than in the corresponding months of 1941 and amounted to only one fourth of the annual quotas allotted to these countries."

The department reported that imports of petroleum asphaltum were all from Mexico and totaled 211,000 barrels valued at $178,000, while domestic production of liquid and solid petroleum asphaltum was 37,000,000 barrels, of which 1,250,000 barrels were exported.

Imports of kerosine also were exclusively from Mexico and amounted to 204,000 barrels valued at $318,000 and, it was pointed out, "although imports in 1940 were considerably larger than those in other years since 1932, they equalled only one third of one percent of United States production, and considerably less than one tenth of United States exports."

The only concessions on United States oil secured from Mexico provided for a guarantee against increases in present Mexican duties on mineral wax and paraffin and three classes of lubricating greases, imports of which from the United States aggregated $1,130,000.

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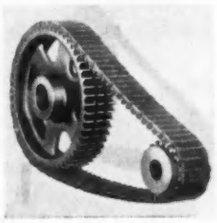
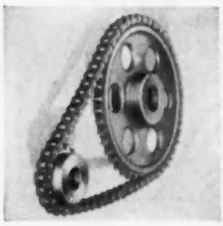
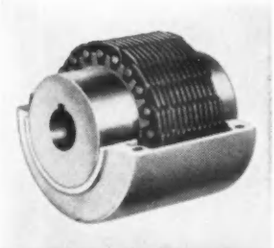


Morse Silent Chain Drives operate at practically 100% efficiency, year after year. Quiet and smooth in operation, they insure maximum machine output. The Morse principle of "Teeth, Not Tension," means no slip—no wasted power. Wide range of chain capacities.

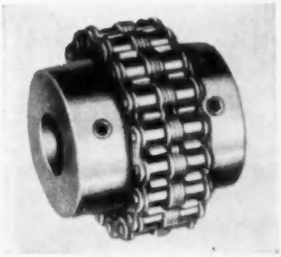
Morse Roller Chain Drives are equipped with effective "oil feed" system in every link. This exclusive design gets oil to the heart of chain. Oil gets in, wear stays out! They last longer, require less maintenance. Interchangeable and available in single and multiple widths.





Morse Silent Chain Couplings compensate for shaft misalignment. This simple and rugged coupling consists of two facing steel sprockets wrapped with Morse Silent Chain—enclosed in a machined split case. Links acting on sprocket teeth form flexing medium. They are easily installed and available in many sizes.

Morse Morflex Couplings contain two steel hub members and a floating center unit assembly to which each hub is separately connected through resilient rubber trunnion blocks. There is no metal on metal movement. Rubber allows for maximum distortion without loss of efficiency. Cuts maintenance cost.



Morse Roller Chain Couplings embody many outstanding features that make for unusual flexibility and long-life. Highly compact, they consist of two facing sprockets wrapped with Morse Roller Chain. Easy to install and align. Wide range of stock and special sizes—covers if desired. Send for coupling data today.

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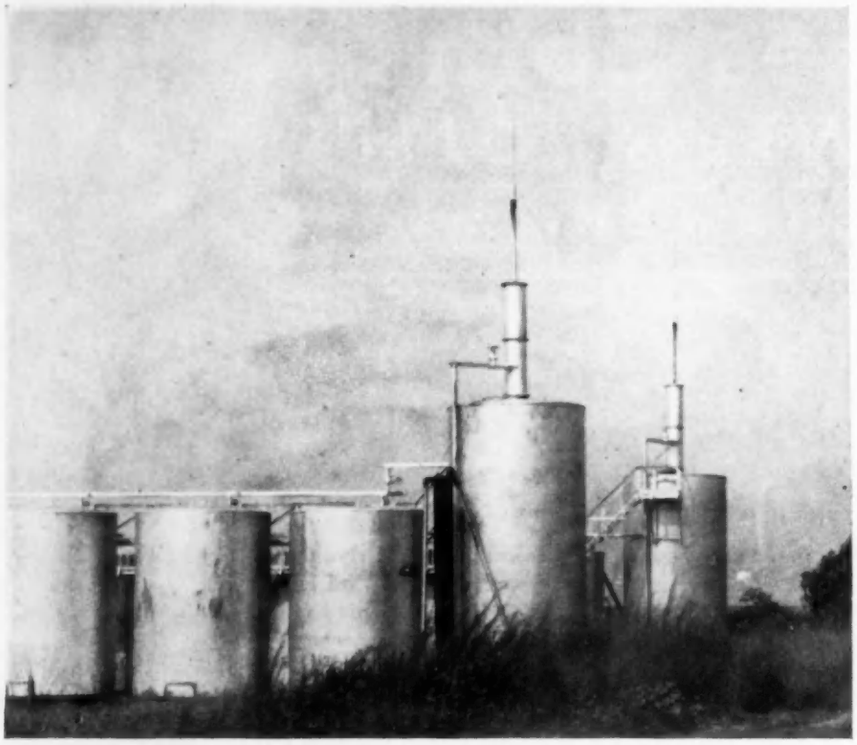
PRACTICAL OPERATING *Hints* FOR

THE practical operating hints for the drilling rig, production man and pipeliner, appearing regularly in these pages, are secured from oil operations everywhere and offer suggestions that will help to improve operating efficiency and safety.

The items give an excellent picture of the remarkable ingenuity being exercised by the operating divisions of the industry. Contributions to these features will be paid for at the rate of $5 for each illustrated item accepted. Address contributions to "The Editor, The Oil Weekly, Houston,"

1. LEASE PROTECTION

Lightning Protection For Lease Tank Vents



Provision of elevated extension above flume carries electrical charge beyond normal path of emitted gases and insures occurrence of flash beyond zone of explosive mixtures.

IN SOME areas, the operators are not allowed to burn the gas going out of the vents and flares, and if they catch fire by accident the blazes must be put out and this is sometimes a lot of trouble. Some leases have the gas vents discharging directly out the top of the flume on the separator and it is both dangerous and annoying to have these vents catch fire.

The gas is usually ignited during an electrical storm because sparks will jump off of the highest sharp objects in an effort to equalize the electrical charges and this point is usually the top of the vent. When the sparks jump, they will invariably set the gas afire and it is sometimes quite a job to get them out, and they often relight several times during one storm.

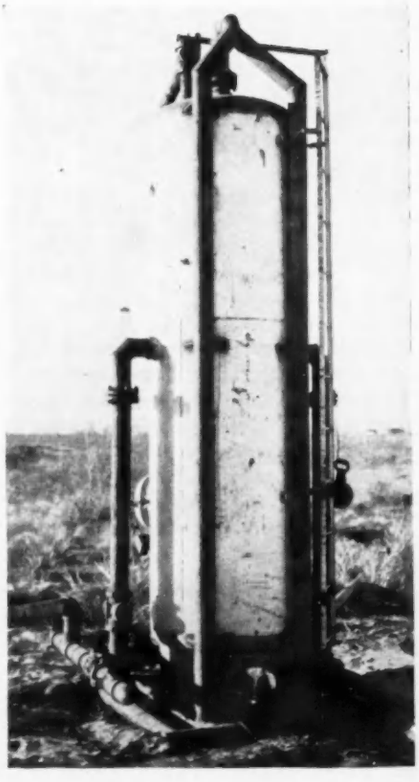
One company solved this trouble by making lightning rods as shown, out of old ¾-inch sucker rods about twelve feet long. They are sharpened at one end and the other end is welded to the gas vent or flare pipe. The rod extends high enough that it is usually above the gas and when the sparks jump, they will jump from this lightning rod and will not ignite the gas. Since installing these rods over a year ago, never has a flare been fired. Fine mesh copper screen is put over the top of the vents so that if they do catch fire, the flame cannot flash back into the tank, as the fire burning on one side of a fine mesh screen will not ignite gas on the other side.

2. SEPARATORS

Standardized Unit for Speeded Well Hook-up

A STANDARD sized separator was completely unitized, fittings being permanently welded into the shell and the dual gas outline lines serving as a skid base. Other lines making up the convenient flow manifold serve as a broad permanent base on which the unit rests while in operating position, installed in the flow line between the newly completed well and the tank batteries. A trap of adequate capacity to handle any size well likely to be drilled was worked over and completely unitized. All oil and gas lines were manifolded at or near the base of the trap, and most of the fittings were welded to the side of the shell. The gas outlet line was divided into a double line at the top of the separator and brought down the side of the shell, the lines being spaced some 18 inches apart, and welded securely to the side of the trap. This double line serves as a handy skid base, facilitating loading and moving of the unit. Other shorter lines making up part of the gas and oil flow line manifold were arranged in such a way as to provide a broad, sturdy base for the unit while it is in operating position.

Each of the fittings permanently welded into the side of the shell is provided with flanged fittings, making it relatively easy to connect the trap to the



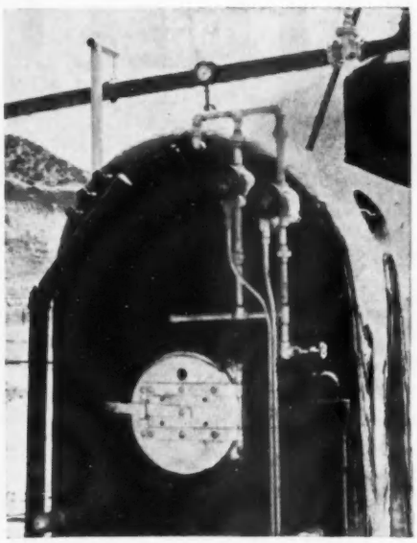
Skid-mounted, completely connected unit needs only flow line to permit full well production.

THE PRODUCTION MAN

field lines when it is ready to be set up at the new location. Manifolding is so arranged that two wells may be hooked into the trap, one on either side of the shell. To prevent injury to the float-arm fitting on the front of the trap, a short section of 10-inch casing, cut in half longitudinally, was welded to the shell over the fitting.

3. GOOD LEASEKEEPING

Effective Drip Drain Protects Boiler Front



Slotted pipe traps try-cock flow and protects unit from unsightly and damaging salt encrustations.

USE of an old-field boiler for heating oil in breaking down emulsions requires frequent checking of oil-water mixtures through the gauge cocks normally used in checking steam-water contact when generating steam. Flow from these cocks, unless carefully trapped, tends to cover the boiler front with salt accumulations, and thus to induce excessive exterior corrosion.

To provide drainage away from the boiler, one company carries a two-inch waste line up along the edge of the boiler front, with a 45-degree ell and short run of pipe directly below the try-cocks.

A slot cut into the pipe aligns with the short drip pipes screwed onto the cocks, carrying away all flow without permitting it to reach the front.

When necessary to renew the cocks, the 45-degree run is swung around on the upright section so as to allow free access to the boiler and permit a wrench to be used unhampered on the cocks.

4. SALT WATER

Insulated Siphon Line Prevents Stoppage

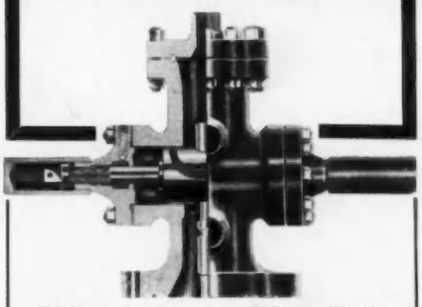
IN AREAS subject to cold snaps or cold spells which are not too prolonged, some trouble is experienced with the siphon lines or "grasshoppers" used to regulate water level in flow tanks, the exposed piping permitting the flow to freeze, especially when the water is carrying more sulphur than brine.

Permanent boxes sometimes built around the risers of these control lines prevent the raising or lowering of the units to control the water-oil ratio, and may result in serious drop from required pipe-line quality.

One company has found that if regular steam pipe insulation be put around the length of the riser, sufficient warmth is carried in the overflow from the tank to maintain the stream above freezing during most of the severe weather encountered, the lagging not interfering with adjustment of the siphon leg.

Tank heat conserved in siphon line to maintain fluidity under severe weather conditions.

RECTOR
ROUND RAM
TUBING HEAD



Tubing may be suspended on (1) the rams, by means of a special recessed tubing coupling, threaded for back pressure valve; (2) on mandrel in bowl above rams; (3) on slips in bowl above rams. In some areas a stripper may be used to run tubing with the rams in the open position. Your composite catalog has complete details.

STOCKS OF ALL TYPES AND SIZES OF RECTORHEADS ARE AVAILABLE FOR IMMEDIATE DELIVERY.

RECTORHEAD
"MAKING THE OIL INDUSTRY SAFER"

EVERYBODY EVERY PAYDAY AT LEAST 10%

WAR MEMO:

The aims behind the War Bond Payroll Savings Plan are worth repeating over and over:

1. To help pay the stupendous production costs of winning this war.

2. To siphon into production channels that portion of America's *current income* which would otherwise flood the Nation with inflationary cash.

3. To create individual backlogs of financial security for use during the industrial readjustment after the war.

4. To create a Nation-wide saving habit which will serve the interests of both Capital and Labor after the war.

Keep after that "10% of gross payroll goal"! Buy War Bonds to the limit yourself—encourage your employees to do likewise!

☆ ☆ ☆ ☆

LIBERTY

versus

Compulsion

We are engaged in the greatest war in history—to determine whether our nation and other nations founded on liberty and the dignity of the individual shall endure.

The struggle is between two totally opposite ideologies. One is based on brute force, the top gang keeping its power by compulsion. The other is based on logic and persuasion, the leaders obtaining office by vote and remaining there only by the consent of the governed. Under regimentation creative research congeals and the masses produce and fight as sullen slaves. Under democracy creative research is stimulated and mass production multiplies. Soldiers go to battle with unbeatable spirit because of the determination of free men to maintain that priceless gift which they have won after ages of fighting and which they will never give up . . . the gift of liberty.

When the war is won and we return to peace time pursuits there will still be a big job to do in rehabilitating a broken world. People everywhere will look to America. Our business men and leaders will have a great responsibility and a great opportunity. In keeping with this thought the Mission Manufacturing Company is planning many advancements and improvements in its products for the benefit of oil men who will be busy to a degree never before experienced. In the meantime war comes first.

Buy Bonds for Victory

and to insure a strong and stable United States when the war is over.

MISSION MANUFACTURING CO.

HUMBLE ROAD HOUSTON, TEXAS

MANUFACTURERS OF:

Mission Slush Pump Valves—Mission Slush Pump Pistons —Mission Piston Rods—Mission Gland Packings—Mission Rotary Slips — Mission Swabs — Mission Plug Valves

The Week's News

Washington Increases January Production Quota

Production of 4,124,200 barrels of petroleum liquids daily in January was set by Administrator Ickes December 21.

The figure represents an increase of 108,300 barrels over the December rate but is 254,800 barrels less than actual production in January, 1942.

The bulk of the increase will be applied in District 3 where, it was said, demand can be met without any reduction in stocks of crude of the area, and in Kansas, where production is raised to offset the general decline in productivity of surrounding areas and thus provide for a maximum movement of products eastward.

The Kansas Corporation Commission, it was said, has been requested to distribute the allocation for the state to the fields that can most efficiently produce the needed quota and from which the oil can be made fully available to consumption centers.

The recommended rates for January make no changes in District 1, where New York is currently permitted to produce 15,400 barrels daily, Pennsylvania 50,700 barrels and West Virginia 17,000 barrels for a total for the district of 83,100 barrels.

In District 2, however, the total is increased from 1,088,100 to 1,092,000 barrels daily, with a number of shifts downward except in the case of Kansas.

Illinois' December rate of 274,100 barrels is reduced to 272,600 barrels; Indiana is reduced from 17,700 to 17,200 barrels; Kansas is increased from 300,700 to 310,000 barrels; Kentucky remains unchanged at 14,200 barrels; Michigan is reduced from 63,800 to 63,700 barrels; Nebraska remains unchanged at 3400 barrels and Ohio at 10,300 barrels, and Oklahoma is reduced from 403,900 to 400,600 barrels.

In District 3, all states were increased except Mississippi, which is left unchanged at 50,000 barrels, and the total for the district is increased from 1,903,500 to 2,007,900 barrels.

Arkansas is increased from 77,300 to 78,300 barrels; Louisiana from 326,100 to 347,500 barrels; New Mexico from 99,700 to 105,300 barrels, and Texas from 1,350,400 to 1,426,800 barrels.

District 4 remains unchanged at 126,200 barrels, with Colorado supplying 7000 barrels, Montana 24,700 barrels and Wyoming 94,500 barrels.

District 5 also remains unchanged, at 815,000 barrels.

Texas January Order Follows PAW Figure

The Texas Railroad Commission has issued its January proration order, fixing a total allowable of 1,426,843 barrels. This is 43 barrels in excess of the recommendation from the Petroleum Administrator for War. However, for the first time, it includes all oils produced in Texas, including condensate, natural gasoline, and distillate.

The commission's basic allowable to be produced each day is 1,391,754 barrels of oil. Usually operators produce 6.05 percent less than the amount of oil assigned, which indicates actual daily average production of 1,307,553 barrels.

To this should be added 119,290 barrels of distillate, condensate and natural gasoline, making a total estimated production of all oils daily of 1,426,843 barrels. The order effects a cut of about 79,000 barrels daily in crude oil. This was effected primarily by reducing the number of producing days to 20 during January. In December, 22 producing days were allowed. Cuts were ordered in some of the minor fields, but these will have little effect on actual production in many cases, because the cut represented the amount of oil which was being taken by the pipe line companies.

The comparative figures for December 1, and January 1, are set out below by districts:

District	December 1	January 1
1 Southewst	20,519	20,687
2 Southwest	96,194	82,247
3 Gulf Coast	295,713	286,724
4 Southwest	110,498	109,846
5 East Central	19,342	18,440
6 East Central	85,151	85,678
East Texas	362,158	330,597
7B West Central	28,354	27,108
7C West Central	19,356	18,535
8 West Texas	201,772	189,731
9 North Texas	127,549	125,108
10 Panhandle	104,052	97,053
Totals	1,470,658	1,301,754

Shutdown Order

Details of the shutdown order are shown below:

General: 20 producing days.

27 producing days: District 2. Heyser & West Ranch. District 3. Lovell's Lake, Amelia, Sugarland, Clear Lake, Webster.

District 4. Orange Grove, Hoffman, Rincon.

District 8. Yates.

District 9. Antelope (Mississippi lime), Bonita, Chapman - McFarlin, Clingingsmith, Hapgood, Hoefle, Kadane, Kadane Shallow, Mankins, Mueller, Ringgold, Sanders, Scotland, Scotland Mississippi Lime, Wilson, Forestburg, Worsham-Steed.

26 producing days: East White Point.

24 producing days: Emperor, Slaughter, Wasson and Panhandle.

19 producing days: Sand Hills Permian and Johnson.

17 producing days: Goldsmith, Abell, North Cowden, Emma, Foster, Fuhrman, Harper, Sand Hills Ordovician, Shipley.

15 producing days: South Cowden, Dune, Keystone (lime), Means, Penwell, Waddell, North Ward, Abell Permian, North Cowden Deep, Fuhrman West, Sharon Ridge.

Exempt from all shutdowns: District 1: Darst Creek, Loma Alta, Luling-Branyon, Salt Flat.

District 2: Cordele, Harmon, Mellon Creek, Mission River, Oakville, Plummer, Victoria and West Mauritz.

District 3: Arriola, Bammel, Barber's Hill, Batson New, Beaumont West, Boling Buckeye, Clay Creek, Conroe, West Conroe, Cotton Lake, Cotton Lake South, Damon Mound, Danbury Dome, Esperson Dome, Eureka Heights, Eureka Heights Deep, Goose Creek, High Island, Hitchcock, Hull, Humble, Humble Light, Kubela, Livingston, Lochridge, Louise, Mercy, Magnet-Withers, Manvel Oligocene, Markham, Mykawa, Mykawa New, North Dayton, Orange West, Raccoon Bend Shallow, Raccoon Bend Cockfield, Sandy Point, Stowell, Silsbee, Turtle Bay, Thompson South, West Columbia and West Columbia New.

District 4: Boule, Charamousca, Clara Driscoll 3800 foot sand, Eagle Hill, Moca, Minnie Bock, Nichols, Seven Sisters, Sam Fordyce, North Sam Fordyce, Plymouth, White Point.

District 5: Mexia, Powell, Richland, Sulphur Bluff, Wortham.

District 6: Boggy Creek, Cayuga, Grapeland, Hawkins, Lone Star, Pittsburg, Talco, Rodessa.

District 7B: Eastland County, Erath County, Loving and Stephens counties.

District 7C: Beddo, Big Lake and World.

District 8: Hendricks, Howard-Glasscock, Iatan - East Howard, Jamison-Pollard, Leck, Monroe, Taylor-Link, Snyder, Welsh.

District 9: Johnson Pool, Fargo, KMA Ellenberger, Hults-Owens, Joy Mississippi Lime, Antelope, Vogtsberger, Walnut Bend.

Michigan Conservation Hearing January 27

P. J. Hoffmaster, director of conservation, Michigan, has called a general hearing for January 27, to review field allowables and general proration programs.

The hearing also will bring the first complete report from a special committee that has been surveying the feasibility of a gas repressuring plant for the Reed City field.

It will be the first public hearing in six months.

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Compact Commission To Broaden Its Program

ANDREW F. SCHOEPPEL, governor-elect of Kansas, was named chairman of the Interstate Oil Compact Commission at its meeting in Oklahoma City December 20. He will take office on January 1, succeeding Governor Leon Phillips of Oklahoma, who has been chairman for the past three years.

J. C. Hunter of Abilene, Texas, representative to the compact, was named first vice chairman, and C. T. Smith, Illinois representative, was elected second vice chairman. J. C. Orr was re-elected secretary, and other employes of the commission will continue in their posts.

Governor Schoeppel will be chairman of the executive committee. Serving with Schoeppel on this committee are Robert S. Kerr, governor-elect of Oklahoma, J. C. Hunter, C. T. Smith, and Hiram Dow, representative of New Mexico.

The next meeting of the commission at which these officers will take full charge of the compact program, will be held in Topeka, Kansas, some time in March. The meeting will go to Kansas because its legislature will be in session at that time, and it might be impossible for Chairman Schoeppel to leave the state.

A much broader program for the coming year was outlined as the various committees reported. An educational program was added. The purpose of this program is to present to the public a better picture of the oil industry and its importance to the war. Undoubtedly, some effort will be made to present programs before various state legislatures in an effort to expand through other states conservation laws similar to those operative in Texas, Oklahoma, New Mexico, Arkansas and the other states where supervision is concentrated in some state regulatory authority.

The establishment of these state boards was seen as the most effective means to prevent further encroachment of federal control. A resolution was adopted pledging loyalty to Harold L. Ickes in his new post as Petroleum Administrator for War, and suggesting that he lean more heavily on the state authorities for information and advice to aid him.

To support this program, the recommendation of the budget and finance committee was adopted, making available $50,000 for next year's work. Expenditures during 1942 will total approximately $22,485. Chairman Schoeppel estimated that about $30,000 would be needed for the expanded program, but his suggestion that the larger sum be available was adopted. Expenses are apportioned among the states in proportion to their production.

Conservation of Strippers

Improved conservation of both oil and gas were urged, most of the meeting being given over to a discussion of the stripper well situation and plans for preserving this vast reserve. The growing importance of gas as a fuel was discussed, and the research and coordinating committee recommended that more time be spent on a study of gas conservation in each reservoir.

"The research and coordinating committee," the formal report said, "again urges consideration of utilizing cooperative operation of pool reservoirs, where economically feasible, to obtain maximum benefits from pressure maintenance and secondary recovery programs . . .

"In the nation-wide survey of stripper-well operations presented at the present meeting, the committee recommends that consideration be given to increasing reserves by maintaining and stimulating stripper-well production and secondary-recovery operations through the establishment of an adequate price for crude oil . . ."

The legal committee presented two model laws, suggested as the basis for the enactment or amendment of conservation statutes in the various states. One of these was in a short form for states where little production is found; the other was longer and more detailed for those states where a larger number of fields would be affected.

The compact extension committee, through Chairman J. C. Hunter, recommended that its life be extended for four years rather than two, which has been the practice in the past. By its own provisions the compact authority from Congress expires on September 1, 1943. Hunter's recommendation that it be extended to 1947 was approved.

A higher price for natural gas was recommended by the regulatory practices committee, headed by Chairman T. A. Morgan of Kansas. This report was taken under advisement.

"There has been considerable discussion concerning the importance of the price paid for gas as affecting its conservation," the report read. "It is a matter of common knowledge that low prices and that existing disparity of prices has created great confusion in the natural gas industry . . .

"The question as to the authority of the states to determine, by statute or otherwise, a minimum price for gas, is, of course, outside of the province of this committee. It has been informally advised, however, by some members of the legal committee that, in the opinion of those expressing it, such authority does exist and can be validly exercised.

"It is therefore our opinion and recommendation that the several gas-producing states should set . . . a minimum price for gas at the well (and that) . . . such minimum price should be set at a figure of not less than five cents per thousand cubic feet."

Ernest O. Thompson, chairman of the Texas Railroad Commission, at the request of Chairman Phillips, outlined the position the commission is taking to support the petroleum administrator in his new position, and to curtail waste by use of the water-oil ratio in the East Texas oil field.

"The Railroad Commission of Texas considers the directives of the Petroleum Administrator for War to be orders from the Commander-in-chief of the Army and Navy, and will carry them out to the letter.

"This means we will produce no more than and no less than he certifies to us as being the amount of crude needed. In the past we have considered recommendations of the petroleum coordinator as recommendations and have followed them in the main.

"Certainly we never produced less than the coordinator said to produce. We have produced, sometimes, more than he said when you conslder the condensates, distillates and naturals. The production of these three items in Texas today runs about 114,000 barrels.

"The December production of crude in Texas is about in line with the recommendation of O.P.C. . . . but we did not include the distillates, condensates and naturals, so the total of all oils produced in Texas (in December) will be about 114,000 barrels (daily) in excess of this recommendation.

"However, for the month of January, our total production of all oils will be as near exactly at the figure ordered for the administrator in his certification as it will humanly be possible to make it.

"The Petroleum War Council has stated that 400,000 barrels per day additional crude will probably be needed in the third quarter of 1943. We have been carefully checking in the State of Texas, and our engineers are of the opinion that Texas can produce at least 400,000 barrels of oil more each day—without physical waste. The transportation facilities would have to be made available, but . . . if the need develops . . . (it) would insure adequate transport families . . ."

Thompson said that the additional oil could come primarily from West Texas and the East Texas field. He said that 200,000 barrels per day more could be produced from West Texas, and with the salt-water-injection program in East Texas, operating as planned, 150,000 barrels daily more could be taken from that one field. The remaining 50,000 barrels would come from fields located in Southwest Texas and the Gulf Coast, although there are some fields in every part of the state that could contribute additional oil (without waste) when the need arises.

Stripper Well Data

Figures on the stripper-well situation were presented by 22 states. At the close of 1941, there were 294,211 stripper wells in operation. During 1941 there were 10,799 producing wells abandoned, and 5206 more were abandoned during the first six months of 1942.

These figures seemed to indicate an increase in the average number of strippers abandoned, being at a rate about 20 percent higher than the average for the six years preceding. In 1940, 8851 of these wells were abandoned.

The figures disclosed that stripper wells amount to nearly 75 percent of the total producing wells, there being 400,679 of the latter at the end of 1941. In the same year, engineers estimated that reserves lost by abandonment of stripper wells totalled 50,186,271 barrels, and that there was added to the total reserves by new stripper wells a total of 490,375,000 barrels.

Stocks of Fuel Oils and Crude Further Reduced

Continued difficulty in meeting requirements of petroleum products was reflected in latest statistics of the industry, covering the week ended December 19. Extremely cold weather in the northern portion of the country forced an abnormally large withdrawal of heating oil from storage, and there was no interruption of steady drawing on stocks of heavy fuel oil. Gasoline again was added to storage, a normal trend for the season, and the addition of a million and a half barrels was about the same as in the previous week and in line with usual accumulations at this time of the year.

Crude runs to stills were 77,000 barrels a day lower than in the previous week in averaging 3,667,000 barrels daily, and were 403,000 barrels per day or 10 percent lower than in the corresponding week last year, when the average was 4,070,000 barrels daily.

Crude oil production of 3,892,000 barrels daily was 11,000 barrels above that in the previous week but 423,000 barrels or 9.8 percent under the output of 4,315,000 barrels per day in the corresponding week last year.

Difficulty in meeting refinery requirements of crude has been indicated by the continued withdrawals of crude from storage. In the week ended December 12, latest period for which figures are available, there was a draft of 1,086,000 barrels from the tanks. Having declined to 231,896,000 barrels, the nation's crude stocks were 10,787,000 barrels (4.4 percent) lower than the total of 242,683,000 barrels reported for December 13, 1941. The new total was within 3,000,000 barrels of the 20-year low that was reached in the fall of 1939 after the concerted shutdown of the Mid-Continent for two weeks.

Texas-origin crude stocks were reduced 1,500,000 barrels in the week of December 12, mainly due to withdrawals in East Texas, West Texas, and on the Gulf Coast. Oklahoma-grade crude stocks were reduced 264,000 barrels, and Rocky Mountain grades 149,000. Most other grades were added to storage, including Illinois-Indiana, Kansas, Mississippi, New Mexico, and California crudes.

Stocks of gas oil and distillate fuel were lowered 1,914,000 barrels between December 12 and 19, having dropped to 45,880,000 barrels. That quantity was 5,607,000 barrels (10.8 percent) less than the 51,487,000 barrels reported as of December 20 last year.

Residual fuel oil in storage December 19 totaled 74,205,000 barrels, 580,000 barrels having been withdrawn during the week. The total was 21,355,000 barrels (22 percent) less than the 95,560,000 barrel on hand December 20, 1941.

Stocks of finished and unfinished gasoline in the United States increased between December 12 and 19 from 77,622,000 to 79,131,000 barrels, a rise of 1,509,000 barrels, compared with a gain of near 2,000,00 barrels in the corresponding week last year. The new total of 79,131,000 barrels was 10,000,000 barrels (11.3 percent) less than that of 89,297,000 reported for December 20, 1941.

Trends of Operations and Changes in Stocks

Figures on crude stocks are from Bureau of Mines weekly reports; all others from American Petroleum Institute weekly reports, which are estimates on Bureau of Mines basis.

ITEM	Crude Oil Prod. Bbls. Day (Add 000)	Crude Oil Prod. Week Ended	Runs to Stills Bbls. Day (Add 000)	Runs to Stills Week Ended	Crude Stocks Bbls. (Add 000)	Crude Stocks Week Ended	Gasoline Stocks Bbls. (Add 000)	Gasoline Stocks Week Ended	Gas Oil & Distillate Stocks Bbls. (Add 000)	Gas Oil & Distillate Stocks Week Ended	Residual Fuel Oil Stocks Bbls. (Add 000)	Residual Fuel Oil Stocks Week Ended
Highs:												
1939	3,910	8- 5	3,650	10-21	278,607	5-26	87,769	4-22	39,562	10-28	116,237	8-26
1940	3,890	3-16	3,690	6-22	265,865	8-31	102,817	4-20	49,051	10-19	109,135	9-14
1941	4,337	11-22	[1]4,120	10-18	266,187	3-29	99,727	3-29	[1]54,983	11-15	102,448	1- 4
1942	[1]4,337	2- 7	3,961	1- 3	263,208	3-28	[1]107,229	3-14	49,861	11-14	95,857	1- 3
Lows:												
1939	[3]1,601	8-26	3,125	2-18	[2]229,127	10-12	71,152	10- 7	20,722	4-15	105,397	4- 8
1940	3,335	11-30	3,370	1- 6	237,339	1-27	79,847	11- 9	23,551	4- 6	102,344	2-10
1941	3,364	1-11	3,490	1-18	240,399	11-15	79,923	10- 4	28,381	4-12	90,914	7-12
1942	3,297	7- 4	3,393	5-23	231,896	12-12	75,934	12- 5	29,240	4-25	74,205	12-19
Trends in 1942 Week Ended):												
Jan. 3	4,038	.....	3,961	.....	244,440	.....	92,987	.....	49,357	.....	95,857	.....
Jan. 31	3,871	.....	3,848	.....	250,740	.....	97,810	.....	40,674	.....	91,189	.....
Feb. 28	4,016	.....	3,675	.....	259,373	.....	105,635	.....	34,547	.....	88,285	.....
Mar. 28	3,820	.....	3,667	.....	263,208	.....	105,624	.....	31,756	.....	83,045	.....
April 25	3,581	.....	3,506	.....	257,073	.....	102,897	.....	29,240	.....	81,107	.....
May 30	3,877	.....	3,522	.....	255,023	.....	95,355	.....	31,384	.....	79,628	.....
June 27	3,719	.....	3,581	.....	253,364	.....	88,396	.....	32,851	.....	77,304	.....
July 25	3,691	.....	3,658	.....	249,262	.....	82,281	.....	35,966	.....	77,816	.....
August 29	3,964	.....	3,697	.....	249,007	.....	80,831	.....	42,060	.....	78,034	.....
September 26	3,909	.....	3,802	.....	242,785	.....	80,550	.....	45,945	.....	78,943	.....
October 31	3,901	.....	3,731	.....	239,266	.....	79,159	.....	48,131	.....	79,166	.....
November 28	3,878	.....	3,736	.....	234,850	.....	78,854	.....	49,739	.....	77,796	.....
December 5	3,834	.....	3,760	.....	232,982	.....	75,934	.....	48,663	.....	75,219	.....
December 12	3,881	.....	3,744	.....	231,896	.....	77,622	.....	47,794	.....	74,785	.....
Dec. 19, 1942	**3,892**	.....	**3,667**	.....	.....	.....	**79,131**	.....	**45,880**	.....	**74,205**	.....
Dec. 20, 1941	4,315	.....	4,070	.....	[4]242,683	.....	89,297	.....	51,487	.....	95,560	.....
Change:												
In week	+11	.....	—77	.....	—1,086	.....	+1,509	.....	—1,914	.....	—580	.....
In year	—423	.....	—403	.....	—10,787	.....	—10,166	.....	—5,607	.....	—21,355	.....
In year	—9.8%	.....	9.9%	.....	—4.4%	.....	—11.3%	.....	—10.8%	.....	—22.3%	.....

[1] All time peak. [2] Lowest since April, 1922. [3] Lowest since October, 1922, due to shutdown of six Mid-Continent States. [4] Stocks, December 13, 1941

Markets Generally Tight; Eastern Shortage Acute

Markets continue generally tight throughout the country, with transportation still inadequate to enable some refiners of the Mid-Continent and Southwest to make shipments of products they have on hand. Some tank cars have been released in consequence of the extension of gasoline rationing into previously unrationed states, but many of the cars have been put to the immediate purpose of replenishing greatly depleted stocks of gasoline, while others have been switched to hauling urgently needed heating oils to the East and North. Sub-zero weather in the northern districts has imposed exceptionally heavy demand for the burning oils, and extreme difficulty has been encountered by suppliers in meeting all needs.

In the East Coast district, scarcity of all products has continued acute, and inventories have been reduced to dangerously low levels. Drastic rationing which has been resorted to apparently was unavoidable.

In the Middle West, there have been special efforts to release supplies for shipment to the East, and refiners gen-

Crude Oil Production in the United States

(Estimates compiled by The Oil Weekly. All figures indicate daily averages, in barrels.)

STATE OR DISTRICT	*State Allowable of Crude Production	PRODUCTION IN WEEK ENDED Dec. 19	PRODUCTION IN WEEK ENDED Dec. 26
Arkansas	74,885	73,600	73,700
California	771,100	774,000	790,200
Long Beach	.....	34,200	33,300
Midway-Sunset	.....	57,300	56,200
Kettleman Hills	.....	41,400	44,900
Wilmington	.....	95,600	96,500
Rest of State	.....	545,500	559,300
Colorado	.....	6,650	6,700
Illinois	.....	240,850	246,350
Salem	.....	31,050	31,600
Louden	.....	44,300	42,900
Other New Pools	.....	154,100	160,100
Old Pools	.....	11,400	11,750
Indiana	.....	16,250	16,300
Kansas	295,500	305,700	291,500
Kentucky	.....	12,650	12,050
Louisiana	300,100	315,900	316,850
North	.....	92,400	92,850
South	.....	223,500	224,000
Michigan	63,675	60,350	60,400
Mississippi	.....	59,150	57,800
Missouri	.....	130	100
Montana	.....	20,050	19,850
Nebraska	.....	2,590	2,900
New Mexico	93,700	94,150	94,400
New York	.....	12,850	13,200
Ohio	.....	10,100	9,250
Oklahoma	373,900	357,150	354,250
Oklahoma City	.....	63,950	62,850
Seminole Area	.....	83,800	83,700
Rest of State	.....	209,400	207,700
Pennsylvania	.....	47,200	48,900
Tennessee	.....	30	35
Texas	1,372,859	1,391,900	1,393,200
Upper Gulf Coast	.....	314,300	314,050
East Texas Field	.....	358,500	358,850
Rest of Eastern Texas	.....	102,000	101,750
Lower Gulf Coast	.....	107,200	107,100
Southwest Texas	.....	50,300	50,150
South Central Texas	.....	17,500	17,950
West Texas	.....	208,900	209,650
North Texas	.....	140,400	140,200
Panhandle	.....	92,800	93,500
Utah	.....	15	10
West Virginia	.....	9,400	8,950
Wyoming	.....	93,800	93,300
Total 8 Prorated States	3,345,719	3,372,750	3,374,500
Total United States	.....	3,904,465	3,910,195

* Details on state allowables in The Oil Weekly of Dec. 7, page 52.

erally have reduced their stocks to exceptionally low points. Although demand for gasoline has declined somewhat because of the extension of rationing, the decrease has been more than offset by increased demand for fuel oils. In fact, some refiners said they simply were unable to meet the heavy needs for the fuels, light and heavy.

In the Oklahoma-Kansas refining district, similarly, there was some let up in demand for gasoline, which offered some relief to suppliers who had been hard pressed by urgent demands for all products. However, as in the Middle West, decline in demand for gasoline was largely offset by increased demand for fuel oils.

Tight markets again were the rule in the Western Pennsylvania refining district, although neutral oils remained in comparatively poor demand. Fuel oils were readily absorbed, and some reduction in gasoline demand following extension of rationing was largely offset by industrial demand and government contracts.

Crude Stock Draft Slowed in October

A 21,000-barrel gain in daily average crude production in October is shown by the monthly report of the Bureau of Mines, but output remained 168,000 barrels a day under the level of October, 1941.

Production for the month was placed by the bureau at 120,311,000 barrels, against 115,801,000 in September and 126,145,000 in the preceding October, the daily average being 3,881,000 barrels against 3,860,000 barrels in the preceding month and 4,069,000 barrels in October of last year.

Kansas was the only state to establish a new high record, with an October average of 292,800 barrels against 286,700 barrels in September. California production showed little change at 723,300 barrels, but output in Texas rose 36,400 barrels to 1,388,900; the increase was quite generally distributed over the state outside of the Panhandle and one or two other districts and was particularly marked in the Texas Gulf Coast, probably as the result of increased allowables in certain aviation-crude fields. Illinois and Mississippi continued on the downgrade.

With runs to stills off and production up, the withdrawal from crude stocks slowed down, only about 2,000,000 barrels being taken out in October compared with more than twice that amount the preceding month.

Daily average crude runs to stills dropped to 3,757,000 barrels from 3,782,000 barrels in September, it was reported. In spite of efforts to reduce the overall gasoline yield in favor of fuel oil, the average rose from 37.9 to 38.6 percent, but there were slight increases in the distillate yield, from 15.9 to 16.2, and that of residual, 26.8 to 26.9.

Total demand for motor fuel in October was placed by the bureau at 53,700,000 barrels, with liquidation of gasoline stocks continuing, bringing them to 76,622,000 barrels at the close of the month compared with 78,146,000 barrels at the end of September and 82,303,000 barrels on October 31, 1941.

Figures of the Bureau of Labor Statistics gave the price index for petroleum and products in October as 60.6, the same as in September and comparing with 61.7 in October, 1941. The crude-oil capacity represented in the report was 4,605,000 barrels, an increase of 22,000 barrels over September, and the operating ratio was 82 percent, compared with 83 percent in September and 89 percent in October, 1941.

Chinese Open Oil Field Far Behind Battle Lines

In the midst of a war for its very existence China has within the past 12 months opened far behind the lines of battle an oil field which has already developed appreciable production, putting China, for the first time, in the list of oil-producing nations.

The extent and location of the production are military secrets but it is no secret that American portable drilling rigs, using internal combustion engines, are being used to drill under rather difficult conditions to a depth of around 1500 feet.

C. Y. Tung, special engineer and mining representative of the Chinese government, is in the United States studying modern drilling and production practices and while his hands are tied in the discussion of details of the Chinese development, he can say that the one field now producing was located by means of surface geology and oil seeps, that its operations were made difficult by reason of the fact that the first 150 feet consists of glacial drift, that shafts must be sunk 150 feet to go through this drift and the drilling begins at that point.

Most of the wells producing to date flow on completion, little gas but considerable hydrostatic pressure being noted. A scimming plant converts the 32-gravity crude into such products as can be made in such a plant.

The operations are being conducted by the Chinese government, mineral resources in the Chinese Republic being the property of the government.

Tung, a graduate of Northeastern University of China, is devoting his attention especially to methods of drilling without the necessity of hand digging an initial shaft for each well.

C. Y. TUNG

Crude Oil Production Is Above Recommended Rate

United States crude oil production averaged 3,910,195 barrels daily in the week ended December 26. This was only a slight change—up 5730 barrels—from the daily output of the previous week.

The 8 prorated states, accounting for about 87 percent of the nation's production, averaged 3,374,500 barrels daily, which was 1750 more than in the previous week, and about 30,000 barrels more than daily production called for during the month by the federal government.

Arkansas increased from 73,600 barrels daily in the week ended December 19 to 73,700 in the week of December 26, while California rose from 774,000 to 790,200, Illinois from 240,850 to 246,350, Louisiana from 315,900 to 316,850, Michigan from 60,350 to 60,400, New Mexico from 94,150 to 94,400, and Texas from 1,391,900 to 1,393,200. Kansas declined from 305,700 to 291,500, Mississippi from 59,150 to 57,800, Montana from 20,050 to 19,850, Oklahoma from 357,150 to 354,250 and Wyoming from 93,800 to 93,300.

Turner Valley Output Reaches Peak This Year

Producing more than 97 percent of the total Canadian output, Alberta will end 1942 with another record-breaking oil and natural-gasoline yield.

The October production report issued by the Petroleum and Natural Gas Conservation Board of Alberta brought the total 1942 yield for 10 months to 8,478,354 barrels.

Estimating the production for November and December at approximately the October yield, the total 1942 output will be 10,158,354 barrels.

Oil production in Alberta has climbed rapidly ever since the Turner Valley Royalties well struck a prolific yield of oil in the South Turner Valley limestone in June, 1936.

The following tabulation shows the oil production, year by year, for the past eight years:

Year	Barrels
1935	1,263,750
1936	1,320,442
1937	2,796,908
1938	6,742,039
1939	7,594,441
1940	8,493,237
1941	9,908,643
1942	10,478,354

The 1942 figure includes estimate of 840,000 barrels each for November and December based on the October yield.

The total Alberta oil production in October of this year of 841,363 barrels comprised 799,268 barrels of oil from Turner Valley; 24,648 barrels of natural gasoline from Turner Valley; and 17,447 barrels of oil from other Alberta fields.

The Vermilion field was the most productive in October outside Turner Valley with the Taber field a close second. Vermilion, with 14 producing wells, yielded 6979 barrels. Taber, with two producing wells, yielded 6086 barrels. Production of other fields was as follows: Red Coulee, 7 wells, 859 barrels; Wainwright, 7 wells, 1347 barrels; Princess, 1 well, 1384 barrels; Del Bonita, 1 well, 556 barrels, including 165 barrels produced before October but not previously reported; and Tilley, 1 well, 236 barrels.

U. S. Field Operations

Kansas

Butler County Pumper Opens New Area

Kansas City-Lansing well in Butler. Barton and Barber County wells showing. Arbuckle saturated in Ellis.

Butler County: J. J. Lynn's Vandenberg 1, SW SE NW 35-27-6e, a wildcat east of Stearn production far enough to be a separate reserve, is producing 45 bbls daily from Kansas City-Lansing at 2118-2131 ft, after treatment with 3000 gallons of acid. Well originally went to Arbuckle, at 3220 ft, but plugged back. Production is pumped. Operaator has staked for a second well.

Barton County: Tom Palmer's Harrison 1, NW NW NE 18-20-13w, on trend three miles north of Hess field, drilled saturated dolomite in the top of the Arbuckle at 3498 ft. Hole is bottomed at 3528 ft with casing run to 3520 ft.

Barber County: Great Lakes Carbon's Welsh 1, in the area of the Sun City pool at NW SW SE 30-31-15w, previously reported as showing from Douglas sands, is pumping 75 bbls of oil and 25 bbls of water daily from 4234 to 4249 ft, after plugging back from dry Arbuckle lime, 5305 ft.

Ellis County: Darby Pet. Co.'s Hall 1, C W½ NE SW 31-12-20w, is preparing to test Arbuckle lime at a point 2-mi east of Gugler field. Well filled 1720 ft in 8 hrs on initial and incomplete test.

KANSAS FIELD COMPLETIONS

Barton County—Kraft Prusa: Cities Service's Ney 1, c sw sw 8-16s-11w, Arb 3291 ft, 2000 gal acid, pump 170 bbls 12 hrs, 3296 ft.

Black-Marshall's Krier 3, c se nw 18-16s-11w, Arb 3289 ft, 3000 bbls, 3311 ft.

Ellis County—Bemis: Wold Creek's Bemis D-1, c w½ sw se 33-11s-17w, Arb 3518 ft, pump 15 bbls oil, 20 wtr 8 hrs, 3552 ft.

Ellsworth County—SW Stoltenberg: Prunty Prod's Haagy 1, c nw ne 20-16s-10w, Arb 3353 ft, abnd 3359 ft.

McPherson County — Unnamed Pool: Auto Ordnance's Bengstorm 1, c w½ nw se 25-17s-4w, Viola 3384 ft, swab 30 bbls oil 2 hrs, 1000 gal acid, 3000 bbls, 3389 ft.

Auto Ordnance's Oakleaf 1, c w½ sw nw 25-17s-4w, Viola 3471 ft, abnd 3548 ft.

Vickers' Hoffman 1, c w½ se sw 25-17s-4w, Viola 3393 ft, perf csg, 3000 gal acid, 1733 bbls, 3540 ft.

Phillips County—Ray: Cities Service's Reese E-1, sw sw se 28-5s-20w, Lans 3270 ft, 1629 bbls, 3692 ft.

Phillips County—Iuka: Skelly's Luders 1, sw nw sw 7-27s-12w, Simp Dolo 4248 ft, 1000 gal acid, pump 109 bbls oil 14 hrs, 4252 ft.

Reno County — Peace Creek: Barnsdall's Glasdell 3, sw se nw 13-23s-10w, Viola 3757 ft, 1000 gal acid, 100 bbls fluid, 40% fac wtr, 3768 ft.

Auto Ordnance's Hollenback 2, sw nw sw 28-23s-10w, Viola 3783 ft, abnd 3810 ft.

Rice County — Chase: Bishop Oil's Callis A-2, sw ne se 22-19s-9w, Arbuckle 3248 ft, abnd 3256 ft.

Russell County—N. Russell: British American and Aylward's Ehrlich 2, sw nw nw 15-13s-14w, Lans 3003 ft, Arb 3294 ft, abnd 3329 ft.

Phil-Han's Boxberger 1, ne nw se 33-13s-14w, Arb 3320 ft, abnd 3324 ft.

Russell County—Trapp: Great Lakes Carbon's Maag 2, se ne sw 7-15s-13w, Arb 3314 ft, abnd 3316 ft.

KANSAS WILDCAT COMPLETIONS

Barton County — Failure: Hollow Drlg.'s Debes 1, c w½ sw nw 30-17s-11w, Howard 2702 ft, Topeka 2744 ft, Heebner 2950 ft, Dodge 2968 ft with sso, Lans 3068 ft with sso 3150-75 ft, 3209-13 ft, ns, Cong 3333 ft, Arb 3382 ft, abnd 3414 ft.

Butler County—New Field: Deep Rock's Eckels 1, c e½ se nw 32-29s-4e, Lans 1870 ft, KC 2190 ft, Miss 2719 ft, Arb 2951 ft, 6⅝-in 2951 ft, 1000 gal acid, 3000 bbls 32.6-gr, 2964 ft.

Harvey County—New Field: H. M. Williams' Stucky 1, c ne ne 3-23s-3w, Miss 3188 ft, perf 3258-61 ft and 3273-77 ft, 9 bbls 28-gr, td 3277 ft.

Phillips County—Failure: Carter and Stanolind's Vogel 1, c ne sw 26-3s-19w, Topeka 2949 ft, Lansing 3172 ft, Arb 3540 ft, abnd 3586 ft.

Reno County—Failure: C. J. Burton et al's Krebiel 1, c se se 10-26s-7w, Lans 3184 ft, Miss 3881 ft, Kinderhook 4038 ft, Misener 4245 ft, Viola 4247 ft, Simpson 4273 ft, abnd 4391 ft.

Rush County—Failure: Vickers' Steitz 1, c s½ sw se 17-19s-18w, Anhy 1260 ft, Neva 2644 ft, Topeka 3280 ft, Lans 3560 ft, Ft Riley 2275 ft, Florence 2385 ft, Breford 2475 ft, sand 3975 ft, Base Cong 3980 ft, Arb 4035 ft, abnd 3085 ft.

Saline County—Failure: E. S. Adkins Weis 1, ne ne nw 32-14s-2w, Topeka 1537 ft, Lans 2027 ft, Base KC 2370 ft, Miss 2670 ft, Base Miss 2940 ft, Misener sand 3067½-68 ft, Hunton 3068-3161 ft, Viola 3233½ ft, Maquoketa Dol 3234 ft, Ferndale Viola 3276 ft, Simpson shale 3372 ft, Simpson sand 3423 ft, Arb 3446-70 ft, abnd 3470 ft.

KANSAS WILDCAT STARTS

Barton County: National & Helmerich & Payne's Haberman 1, sw sw sw 27-18s-13w, mim.

Cowley County: Adair & Morton's Ahlerichs 1, nw nw se 7-31s-4e, cellar.

Greenwood County: Dunn & Lewis' Arnold 1, c ne nw 9-26s-13e, sd.

McPherson County: Globe Oil & Refg.'s Strouse 1, sw sw ne 4-20s-3w, lcn.

Rice County: Rocket Drlg. & Texon's Frevert 1, sw se sw 30-18s-10w, sur.

Saline County: Max Cohen's J. Sjo 1, nw nw nw 14-16s-4w, lcn.

Oklahoma

Seminole Edge Well Flows 22 Barrels Hour

Wilcox sand test west of Edmond field. Viola show in Atoka. Seminole edge well comes in.

Oklahoma County: Kerr-McGee et al's Gutowsky 1, NW NW SW 33-14-4w, is a location for a Wilcox sand test west of Edmond field productive in Wilcox sand along Nemaha Ridge. The test will be drilled on an 8000-acre block, and is scheduled for 7500 ft or the sand. Well will be 3 miles west of production.

Atoka County: A thick section of Viola lime has been encountered at Burns Oil Co.'s Kinch 1-A, NW SW SE 18-3s-10e, far from production. Well is drilling below 3100 ft after finding 500 ft of the formation. Oil and gas shows were found in the top of the formation, untested, the balance being hard and dry.

Seminole County: The east edge of the Seminole area has been given a new well that might presage additional Hunton lime exploration in this immediate vicinity. Oklahoma Oil Corp.'s Tiger 1, C NW NE 13-9-6e, topped the lime at 3941 and after drilling to 3983 ft, filled 1000 ft in 4 hrs. Treated with 2000 gallons of acid, it flowed at steady rate of 22 bbls per hr.

OKLAHOMA FIELD COMPLETIONS

Creek County—Bristow: Tibbens' Allen 1, c nw se 1-15n-9e, sand 2838-42 ft, shot 40 qts, pump 5 bbls, 2854 ft.

Creek County—Cushing: J. E. Crosbie's Jones 1, c ne sw 12-18n-7e, Skinner 2690 ft, shot 70 qts 2690-2708 ft, flow 40 bbls, 2708 ft.

Kay County — Dilworth: National Union's Curry 2, ne sw sw 19-28n-1e, Wx 3345-55 ft, pump 53 bbls, 3357 ft.

Marshall County—Cumberland: Pure's McCasland 114-1, se se ne 19-5s-7e, McL 5584 ft, flow 1305 bbls, 6055 ft.

Noble County—Tonkawa: Ingling & Parker's Gravel 1, c sw ne 20-24n-1w, Tonkawa 2640 ft, abnd 2740 ft.

Okfuskee County—Bearden: Titus et al's Summer 1, c sw sw 6-10n-9e, Cromwell 3426 ft, 5 mcfg, 3433 ft.

Okfuskee County — N. Okemah: British American's Bloss A-2, sw se sw 36-12n-9e, Gilcrease 3115 ft, flow 210 bbls, 3124 ft.

Okmulgee County—Moris: H. E. Hazlett's

U. S. Drilling Operations in Week Ended December 26, 1942

STATE	ALL WELLS COMPLETED — THIS WEEK Total	Oil	Gas	Dry	*Miscel.	Total 1942	Total this Date 1941	‡WILDCATS COMPLETED — THIS WEEK Total	Oil	Gas	Dry	Distillate	Total 1942
Alabama						3	5						3
Arizona						3							3
Arkansas						124	185						19
California	18	15		3		814	1,118	3			3		119
Colorado						15	21						3
Florida						1	1						1
Georgia						2	1						2
Illincis	35	28		6	1	2,193	3,935	3			3		588
Indiana	6	1		3	2	374	546	1			1		92
Iowa							6						
Kansas	22	10		12		1,604	2,217	7	2		5		363
Kentucky	5	3		2		169	335	2			2		41
Louisiana	4	4				899	1,557						137
Michigan	12	7	1	4		666	885	2			2		177
Mississippi						100	198						42
Missouri						34	85						21
Montana						193	250						7
Nebraska						28	93						14
New Mexico	6	3	1	2		383	397	2			2		49
New York	27	20		7		†1,245	1,119						1
Ohio	24	5	11	8		1,134	1,774						
Oklahoma	35	10	2	18	5	1,428	2,162	8			8		295
Pennsylvania	45	42	3			3,849	3,944						
Tennessee						8	23						5
Texas	52	20	1	28	3	5,144	10,439	10		1	9		1,052
Utah							3						
Virginia						1							
West Virginia	19	4	12	1	2	763	774						
Wyoming						98	137						11
Total this week	310	172	31	94	13	21,275	32,210	38	2	1	35		3,945
†Total last week	349	195	35	108	11	20,965	31,644	44	7	2	35		3,977
†Total this year	21,275	10,988	1,852	5,622	2,813			3,045	416	58	2,563	8	

* Includes old wells deepened, water intake, gas input, salt water disposal, and distillate wells.
‡ OPC program calls for 4,000 wildcats in 1942 ,of which 624 should produce oil and 116 gas, leaving 3,260 dry.
† Revised.

N. Sampson 9, c s½ nw 30-13n-15e, Misener 2766-70 ft, abnd 2852 ft.

Okmulgee County—Pollyanna: Minshell & Lowery's Doneghy 1, c nw nw 6-15n-12e, Dutcher 2263-95 ft, abnd 2295 ft.

Okmulgee County—Picket Prairie: Junior O&G Co.'s Ricks 1, ne sw sw 2-16n-11e, Taneha 2165 ft, abnd 2210 ft.

Osage County—Wildhorse: Mid-Continent's 1, c nw sw 29-22n-10e, Arb 2468 ft, Bartlesville 1878 ft, abnd 2491 ft.

Osage County—Avant: Sinclair Prairie's 65, c n½ s½ nw 20-23n-12e, Bartlesville 1715 ft, pay 1715-58 ft, pump 2 bbls, 1785 ft.

Sinclair Prairie's 66, sw ne nw 20-23n-12e, Bartlesville 1717 ft, repress well, 1750 ft.

Osage County—Nelagoney: Cities Service's 484, ne nw nw 10-25n-10e, Miss 1997, 700,000 cfg, 600 lbs rock press, 2004 ft.

Pawnee County—Garr: Hall Brisco's Whitlich 1, c ne ne 32-20n-5e, Wx 3707 ft, abnd 3708 ft.

Pontotoc County—Wetley: Delaney's John Goodson 1, c ne ne 27-5n-5e, Viola 2495 ft, 3000 gal acid, pump 210 bbls, 2586 ft.

Pontotoc County—Beebe: Delaney's Kenneth Goodson 1, c se ne 27-5n-5e, Viola 2560 ft, abnd 2650 ft.

Pottawatomie County—W. Hotulke: Smith Bros.' Billington 1, se ne se 22-9n-4e, Viola 4332 ft, perf 4356-81 ft, 4500 gal acid, pump 50 bbls, td 4473 ft.

Seminole County — W. Grayson: Phillips' Beggars 1, c se ne 15-6n-5e, Cyp 3042 ft, abnd 3068 ft.

Stephens County—Velma: Skelly's Franklin 30, nw nw se 35-1s-5w, sand 652 and 675-83 ft, pump 25 bbls oil 10 hrs, 737 ft.

Stephens County—Empire: C. B. Christie's Cummings 1, sw sw ne 27-1s-8w, abnd 2303 ft.

Stephens County—Woolsey: Fair Operating Co.'s Baker A-5, se nw ne 35-2s-6w, abnd 24 ft.

Fair Operating Co.'s Baker B-3, sw nw ne 35-2s-6w, top sd 1848 ft, pump 4 bbls oil, 40 wtr, 1853 ft.

OKLAHOMA WELLS DEEPENED

Kiowa County—Hobart: Shell's Kelsy 1, nw nw sw 20-7n-17w, otd 1182 ft, lm 1150 ft, pump 310 bbls, 1197 ft.

Muskogee County — Haskell: Haskell Gas' Way 6, se se se 34-16n-15e, otd 1123 ft, abnd 1135 ft.

Osage County—S. Hominy: Okla. Power & Water Co.'s 143, nw se sw 30-22n-9e, otd 454 ft, Oswego 1878-1922 ft, Bartlesville 2246 ft, 1,250,000 cfg, 2256 ft.

Osage County—Happy Hollow: F. M. Pinney's 1, se sw nw 15-24n-8e, otd 2032 ft, Arbuckle 2665 ft, abnd 2674 ft.

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OKLAHOMA WILDCAT COMPLETIONS

Lincoln County—Failure: Wilcox's Kolar 2, sw sw ne 8-12n-6e, Hogs 2030 ft, Osw 3280 ft, Prue 3298 ft, Skinner 3457 ft, Inola 3770 ft, Miss 4225 ft, Wood 4373 ft, Misener 4406 ft, Hunton 4410 ft, Syl 4499 ft, Viola 4580 ft, 1st Wx 4565, sso, 2nd Wx 4702 ft, abnd 4702 ft.

Atlantic's Barnes 1-A, se se nw 11-16n-2e, Hogs 3339 ft, Lay 3355 ft, Osw 4070 ft, Inola 4412 ft, sand 4438-93 ft, Miss 4585 ft, Wood 4641 ft, Hunton 4681 ft, Syl 4760 ft, Viola 4851 ft, 1st Wx 4928 ft, abnd 5057 ft.

Noble County—Failure: Deep Rock's Blackhawk 1, nw nw ne 21-23n-2e, Oread 1770 ft, Indi 2145 ft, Tonk 2280 ft, Avant 2545 ft, Perry gas sand 2575 ft, Miss 4073 ft, Wood 4350 ft, abnd 4487 ft.

Oklahoma County—Failure: Kerlyn et al's Shadle 1, sw nw nw 7-11n-3w, Paw 3265-3345 ft, Carmi sand 4010 ft, Oread 4260 ft, Ccb 5300 ft, 1st Ool zone 5490 ft, Osw 5940-6040 ft, Base Penn and Wood 6216 ft, Hunton 6450 ft, Syl 6385 ft, abnd 6798 ft.

Osage County—Failure: Norbla & Sinclair's Osage 1, nw nw nw 17-23n-7e, Big lm 2205 ft, abnd 2390 ft.

Norbla & Sinclair's Osage 1, sw sw ne 4-26n-5e, Big lm 2628 ft, abnd 3135 ft.

Pottawatomie County—Failure: Phillips'Nix 1, c sw se 26-8n-3e, U. Belle City 2590 ft, Hogs 2673 ft, Ccb 3355 ft, Calvin 3800 ft, Senora lm 3980 ft, Allen 3984 ft, Brown lm 4400 ft, Dutcher 4418 ft, Mayes 4420 ft, Wood 4505 ft, Hunton 4739 ft, Syl 4740 ft, Viola 4808 ft, Dense 4856 ft, Dolo 4908 ft, 2nd Wx 5115 ft, abnd 5136 ft.

Stephens County—Failure: Kingrey Bros.' Ketchum 1, c ne sw 3-1n-9w, Granite wash 1668 ft, dry sand 1687-1727 ft, Gr wash 1732-59 ft, dry sand 1824-31 ft and 1895-99 ft, dry granite wash 2419-24 ft, shale and wash 2475-2518 ft, abnd 2518 ft.

OKLAHOMA WILDCAT STARTS

Lincoln County: W. O. Allen's Jarvis 1, nw ne ne 4-16n-2e, lcn.

Noble County: L. H. Wentz's Bieberdorf 1, nw ne nw 15-21n-2e, lcn.

Ingling & Parker's Levy Est. 1, c s½ se se 10-23n-1w, rur.

Pawnee County: Riverland Oil's Chief 1, sw nw nw 30-22n-4e, lcn.

Seminole County: Harry Diamond, Inc.'s Scott 1, se se sw 2-6n-5e, lcn.

Illinois Basin

ILLINOIS FIELD COMPLETIONS

Clay County: Texas Co.'s Nedler 5, c nw se 5-5n-7e, McCl 2810-12 ft, 18 bbls, 2884 ft.

Franklin County: E. S. Adkins' Peabody Coal 1, nw nw sw 18-7s-3e, Tar Spgs 2037-55 ft, 108 bbls, 2055 ft.

Gallatin County: Dickerson & Lieberknecht's Moye 1, nw sw ne 15-8s-9e, Weiler 2492-502 ft, 142 bbls, 2521 ft.

Cherry & Kidd's Kerwin 7, sw se sw 11-8s-10e, Tar Spgs 2050-58 ft & 2061-70 ft, Walts 1957-65 ft, 75 bbls, 2075 ft.

Cherry & Kidd's Kerwin 17, nw nw ne 14-8s-10e, abnd 2093 ft.

Carter's G. Jordan 3, ne nw ne 21-8s-10e, Cyp 2405-11 ft & Walts 1982-2006 ft, 62 bbls, 2420 ft.

Hamilton County: Shell's Daily 13, se nw ne 12-6s-6e, Aux V 2998-3033 ft, 236 bbls, 3055 ft.

Pure's Layman A-3, nw ne sw 17-6s-7e, Weiler Ss 2747-50 ft & 2762-70 ft, 49 bbls, 2770 ft.

Jasper County: Pure's Swick Consol 2, c sw ne 20-6n-10e, McCl 2819-30 ft, 23 bbls, 2835 ft.

Lawrence County: Central Pipe Line Co.'s Hovermale 1, c se sw ne 23-2n-12w, Biehl 1378-94 ft, 140 bbls, 1394 ft.

Bell Bros.' Hoh 1, c nw sw sw 24-2n-12w, Rosi 2028-33 ft, 41 bbls, 2130 ft.

Smith & Nye's E. Spidel 1-C, c se sw nw 26-2n-12w, Biehl 1340-72 ft, 85 bbls, 1383 ft.

Richland County: Sun's Miller 1, c se nw ne 26-5n-10e, McCl 2945-50 ft, 337 bbls, 2950 ft.

Wabash County: Wall's Zimmerman 1, c ne sw nw 5-1n-12w, abnd 1635 ft.

Horton & Wiggins' Carson 1, c e½ ne sw 16-1s-12w, Cyp Ss 1997-99 ft, 30 bbls, 2357 ft.

Wayne County: Pure's Riggs A-1, c se sw 2-1n-7e, Aux V sd 2944-61 ft, 220 bbls, 2968 ft.

Pure's Patterson 1, nw se se 21-2n-8e, McCl 3026-41 ft, 69 bbls, 3060 ft.

Texas Co.'s Combs 1, c n½ nw se 8-3s-6e, abnd 3477 ft.

White County: S. C. Yingling's Bretz 2, sw sw sw 20-3s-14w, Weiler 2805-23 ft, 175 bbls, 2825 ft.

Superior's Collins 5, sw se 22-4s-14w, Cyp sd 2592-2608 ft, 150 bbls, 2852 ft.

Superior's Fitton 38, sw sw 23-4s-14w, Cyp 2645-55 ft & 2594-96 ft, 250 bbls, 2655 ft.

Jarvis Bros.' Spencer 7, se ne sw 31-4s-11e, Tar Spgs 2328-47 ft, 460 bbls, 2347 ft.

Jarvis Bros.' Spencer 8, sw nw sw 31-4s-11e, Clore sd 1988-92 ft, 30 bbls, 2424 ft.

Jarvis Bros. & Marcell's Spencer Comm. 4, ne sw sw 31-4s-11e, Tar Spgs 2317-37 ft, 130 bbls, 2337 ft.

Seaboard's Redstock 1, sw se ne 4-5s-9e, Aux V 3208-30 ft, 25 bbls, 3416 ft.

Hollandsworth et al's Renshaw 2, ne se ne 1-5s-10e, Tar Spgs 2275-2324 ft, 152 bbls, 2331 ft.

Jarvis Bros. & Marcell's Cleveland 4, se ne ne 1-5s-10e, Tar Spgs 2332-47 ft, 250 bbls, 2347 ft.

Keystone Royalties' Cleveland 1, ne sw ne 1-5s-10e, Tar Spgs 2307-26 ft, 20 bbls, 3069 ft.

Pure-Carter's Martin 2, se se ne 18-6s-9e, Pt Crk 2754-2800 ft, 135 bbls, 2800 ft.

Pure's Pyle Consol 2, se sw se 18-6s-9e, Aux V 2902-14 ft, 152 bbls, 2915 ft.

H. K. Riddle's Myers 2, ne se sw 12-6s-10e, Tar Spgs 2198-2216 ft, 85 bbls, 2867 ft.

ILLINOIS WILDCAT COMPLETIONS

Bond County — Failure: W. C. McBride's Keith 1, sw sw ne 30-4n-2w, abnd 1240 ft.

Clay County—Failure: K. M. Bayer's Allison 1, se se se 25-3n-5e, abnd 2970 ft.

White County—Failure: Sheridan & Heath's Ralston, Tr. 1, sw ne sw 24-5s-8e, abnd 3300 ft.

ILLINOIS WELL DEEPENED

Clinton County: Ashoff, Jr.'s, Huelsman 1, se ne ne 20-1n-3w, Devonian 2463-78 ft, otd 1267 ft, 100 bbls, 2478 ft.

ILLINOIS WILDCAT STARTS

Clinton County: Schio and Sunray's Wassen et al 1, sw sw ne 7-3n-1w, lcn.

Crawford County: Rush & Merideth's Mushrush 1, ne se ne 20-5n-13w, lcn.

Edwards County: Ohio's Harris 1, se se ne 18-2s-10e, lcn.

Fayette County: Skelly's Bethards 1, sw sw ne 35-6n-1e, lcn.

Lawrence County: Schaffer et al's Ebbet 1, se se nw 26-4n-12w, lcn.

Madison County: Kingwood's Niggli 1, ne ne ne 29-5n-5w, lcn.

Monroe County: Columbia American Distillers' Fee 1, c se 16-1s-10w, dr.

Wayne County: E. O. Olds' Whiteside 1, e½ se ne 18-1n-11w, dr.

Larry Romaine's Kinney 1, ne se ne 16-1s-8e, lcn.

Deep Rock's Gardner 1, sw sw nw 15-3s-8e, lcn.

White County: W. C. McBride's Doerr 1, sw ne se 34-4s-9e, lcn.

INDIANA FIELD COMPLETIONS

Daviess County: R. D. Brown, Inc.'s, Kelly 1, c s½ ne sw 16-2n-6w, abnd 886 ft.

Gibson County: Continental's Maier 58, c n¼ nw nw 7-3s-13w, abnd 2497 ft.

Vanderburg County: United Oil's Stader 2, nw se nw 32-6s-11w, Walts 1713-24 ft, 100 bbls, 1724 ft.

INDIANA WELLS DEEPENED

Daviess County: General Oil's Singleton 2, sw sw 21-2n-7w, abnd 1310 ft.

Gibson County: R. D. Brown, Inc.'s, Lehman 4, nw se nw 36-1s-10w, Hardins 1406-18 ft, otd 1419 ft, 2700 mcfg, 1440 ft.

INDIANA WILDCAT COMPLETIONS

Posey County—Failure: Sohio's Ries-Ellert Comm. 1, se ne nw 18-8s-13w, abnd 2796 ft.

INDIANA WILDCAT STARTS

Perry County: A. J. Glen's Fee 1, c sw se 7-6s-1w, dr.

St. Clair County: Shell's Thomas 1, sw nw nw 14-1s-8e, lcn.

KENTUCKY FIELD COMPLETIONS

Henderson County: Bintliff's Burbank A-1, 4-P-21, Cyp 2297-2306 ft, 700 bbls, 2306 ft.

Sinclair Prairie's Burbank 4, 4-P-21, Cyp 2295-2306 ft, 400 bbls, 2306 ft.

Gulf's Williams 1, 24-Q-21, Cyp 2305-2315 ft, 158 bbls, 2315 ft.

KENTUCKY WILDCAT COMPLETIONS

McLean County — Failure: E. L. Newton's Stroud 1 (2), 13-L-28, abnd 2420 ft.

Muhlenberg County—Failure: M. Robson's Glenn 1, 16-G-28, abnd 1005 ft.

KENTUCKY WILDCAT STARTS

Henderson County: Carter's Eakins 1, 4-N-24, lcn.

Carter's Barrett 1, 25-P-25, lcn.

Union County: R. S. Gardenhire's Drury 1, 2-6-20, lcn.

Texas Ruling Goes Before High Court

The United States Supreme Court on December 14 agreed to determine whether a federal district court has jurisdiction to consider suits dealing with the Texas oil law.

The court granted a petition of the state authorities for review of a Fifth Circuit Court of Appeals decision that a lower court should consider a suit challenging the Texas Railroad Commission's order permitting O. L. Hastings and C. F. Dodson to drill on a 3.85-acre tract in Rusk County, brought by Selby Oil Company and Lewis Producing Company.

The district court dismissed the suit on the ground that it was without jurisdiction to set aside an order of the commission and the circuit court reversed the decision.

The eyes of all America are upon the United States Treasury Roll of Honor appearing in the "Payroll Savings News." For copy write War Savings Staff, Treasury Department, Washington, D. C.

HOW TO "TOP THAT 10% BY NEW YEAR'S"

Out of the 13 labor-management conferences sponsored by the National Committee for Payroll Savings and conducted by the Treasury Department throughout the Nation has come this formula for reaching the 10% of gross payroll War Bond objective:

1. ***Decide to get 10%.***
   It has been the Treasury experience wherever management and labor have gotten together and decided the job could be done, the job was done.
2. ***Get a committee of labor and management to work out details for solicitation.***
   a. They, in turn, will appoint captain-leaders or chairmen who will be responsible for actual solicitation of no more than 10 workers.
   b. A card should be prepared for each and every worker with his name on it.
   c. An estimate should be made of the possible amount each worker can set aside so that an "over-all" of 10% is achieved. Some may not be able to set aside 10%, others can save more.
3. ***Set aside a date to start the drive.***
4. ***There should be little or no time between the announcement of the drive and the drive itself.***
   The drive should last not over 1 week.
5. The opening of the drive may be through a talk, a rally, or just a plain announcement in each department.
6. Schedule competition between departments; show progress charts daily.
7. Set as a goal the Treasury flag with a "T."

AS of today, more than 20,000 firms of all sizes have reached the "Honor Roll" goal of at least 10% of the gross payroll in War Bonds. This is a glorious testimony to the voluntary American way of facing emergencies.

But there is still more to be done. By January 1st, 1943, the Treasury hopes to raise participation from the present total of around 20,000,000 employees investing an average of 8% of earnings to over 30,000,000 investing an average of at least 10% of earnings in War Bonds.

You are urged to set your own sights accordingly and to do all in your power to start the new year on the Roll of Honor, to give War Bonds for bonuses, and to purchase up to the limit, both personally and as a company, of Series F and G Bonds. (Remember that the new limitation of purchases of F and G Bonds in any one calendar year has been increased from $50,000 to $100,000.)

TIME IS SHORT. Our country is counting on you to—

"TOP THAT 10% BY NEW YEAR'S"

Save with

War Savings Bonds

This space is a Contribution to America's All-Out War Effort by THE OIL WEEKLY

New Mexico

NEW MEXICO FIELD COMPLETIONS

Eddy County: Western Prod. Co.'s Burch 4-C, c nw se 23-17s-29e, flow 90 bbls, 2-in, acid 6500 gals 2822-2915 ft, td 3058 ft.

J. B. Mulcock et al's Etz 2, c se sw 25-16s-30e, elev 3798 ft, top red sand 2318 ft, 4,000,000 gas natural, 2954-3016 ft.

Roland R. Wooley et al's Arnold 2-A, c sw ne 26-17s-30e, flow 145 bbls cas, shot 150 qts 3212-78 ft, td 3300 ft.

Lea County—Eunice: T. P. Coal & Oil Co.'s State 23-A, c se ne 8-22s-36e, flow 192 bbls 2-in, acid 7000 gals 3800-70 ft.

NEW MEXICO WILDCAT START

Eddy County: Broderick et al's State 1, c ne se 8-17s-29e, mim.

NEW MEXICO WILDCAT COMPLETIONS

Lea County — Failure: Feltmont Corp.'s State 1, c lot 11, 5-21s-33e, elev 3765 ft, top sanhydrite 1670 ft, salt 1802-3640 ft, brown lime 3693 ft, abnd 3717 ft.

Da Baca County—Failure: South Basin Oil Co.'s Goode 1, 661 ft from n and 330 ft from e lines 5-4n-20e, elev 5070 ft, top brown lime 3812 ft, top schist 4750 ft, abnd 4779 ft.

West Texas

Gaines County Test Sets Pipe for Production Try

Ordovician prospect in Crane County failed to make producer, but further explorations due. Deep test in Keystone field yields little gas with water. Pipe set for completion try by Gaines County deep test.

Crane County: Gulf's Dawson 1-A, 4½ miles west of regular Permian production in McCamey district, yielded nominal amount of low-gravity oil with water after perforating pipe by stages opposite saturation in Simpson, topped 5160 ft. This wildcat established exceptionally high structural condition for region, and was plugged back after finding sulphur water in Ellenburger at 5305-5505 ft, elevation 2348 ft. Plugging orders are pending. Company proposes to continue exploratory work on its block. Gulf's Estes 1, 3 miles west of deep production in Sand Hills field, drilling Basal Permian at 5600 ft. Oil saturation was passed up in Holt section of Permian. Magnolia's Tucker 1, offset to its McKee pool discovery, entered Ellenburger at 6950 ft, elevation 2452 ft, and was without saturation in coring to 7038 ft.

Winkler County: Amon G. Carter's Walton-Pure 2-C, Ordovician project for Keystone field, resumed coring after recovering 500 ft of gas-cut mud and 2400 ft of sulphur water on drill-stem test at 7010-7160 ft. Shell's Blue 1, east edge of county, was drilling shale at 8340 ft on Ellenburger objective.

Gaines County: Shell's Leaverton 1, 4 miles southwest of Wasson field, cemented 5-in at 7480 ft to test broken saturation logged at intervals to bottom at 7772 ft in Clear Fork zone of Permian. If this test proves non-productive, perforations will be made opposite saturation at 6735-6860 ft.

Pecos County: Magnolia's Robertson 1, situated near east edge of Delaware basin, was drilling shale at 7290 ft in Basal Permian. Phillips Petroleum Co.'s Price 1, scheduled 8500-ft test in southeast portion of county, was drilling shale at 8360 ft without shows.

Sterling County: Ohio's Clark 1, 10 miles west of Water Valley, was drilling shale at 6440 ft. Col-Tex Refining Co.'s Reed 1, 15 miles northwest of Sterling City, logged nominal porosity in coring to 4735 ft. Both are due to continue to Ellenburger.

WEST TEXAS COMPLETIONS

Andrews County—Fullerton: Fullerton's Oil Co.'s McKean-Eilers 1, c sw sw PSL 14, blk A-32, elev 3355 ft, flow 1676 bbls 1-in, acid 18,000 gals Clear Fork 6775-7260 ft.

Andrews County—Mascho: N. G. Penrose, Inc.'s, University-Ohio 1-B, c sw se sec 14, blk 10, pump 116 bbls, shot 240 qts 4510-4620 ft, td 4630 ft.

Cochran County — Slaughter: Devonian et al's Duggan 24-A, 510 ft from SEc lab 3, leag 55, Oldham CSL, flow 759 bbls cas, acid 12,000 gals 4974-5025 ft.

Crane County—Sand Hills: Magnolia's Lea 5, c se sw PSL B-32, flow 316 bbls 20/64-in, flow valves input gas, acid 8000 gals 4362-4600 ft.

Gaines County—Wasson: Continental's Was-

The OIL WEEKLY'S TRADING POST

USED EQUIPMENT FORUM

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FOR SALE

■ 4—40 H.P. Superior "Two Cycle" Gas Engines with reversible clutches. Good Condition. 1—40 H.P. Fairbanks-Morse Diesel Engine. Vertical, type VA Model 32, with starting equipment. Good Condition. STROUBE & STROUBE, Corsicana, Texas.

■ Used High and Low Pressure Guaranteed Valves, Structural Shapes, Steel Shafting, 2 Million Fire Bricks, any type boiler, air compressors. Steel Buildings. INDUSTRIAL SUPPLY & EQUIPMENT CO., INC., 338 Baronne Street, New Orleans, La. Raymond 0889.

FOR SALE

WELDED STEEL BARGES

120′ x 32′ x 8′
110′ x 30′ x 7′6″

Built for deck load or liquid cargo, oil-tight compartments.

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W. HORACE WILLIAMS COMPANY
833 HOWARD AVENUE
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USED SPUDDERS

Almost new (used less than 9 months) "Cardwell" Model K Double Drum Spudder mounted on steel Skids, with Mast, Steel Top, Side Curtains, Drilling Tools, Hand Tools, Fittings, 145 H.P. Waukesha Engine, 1500 Watt Kohler Light Plant, Wire Lines, etc. Specifications 1942 Composite Catalog, Page 584. Everything in fine condition. Ready for immediate delivery from our yards at Salem, Illinois.

THE BRIDGEPORT MACHINE COMPANY
WICHITA, KANSAS

■ FOR SALE: 43 Joints 1290 feet New Youngstown 3½″ OD 13.30-lb. Grade D Smls. Internal Upset Drill Pipe Range 2. Also 9 Joints 261 feet out of same string, slightly used, with Hinderliter FH 3 Way Pack-off Tool Joints on each joint. 78 Joints 2340 feet 5-9/16″ OD 22.20-lb. Youngstown Grade D Range 2 Internal Upset Seamless Drill Pipe with Reed FH Tool Joints on each joint. This string used but in first-class used condition. Both strings situated on railroad siding at Wickett, Ward County, Texas. For Prices, write or wire A. R. Eppenauer, Pecos, Texas.

FOR SALE

■ For Sale: 11,000′ 2″ 4½-lb. used Lapweld Tubing. 6000′ ⅝x25′ used Sucker Rods. 5 100-bbl. used Steel Bolted Tanks. Located at Pioneer, Texas. Keystone Production Company, Fort Worth, Texas.

FOR SALE—Two 250 hp. boilers, two stage air compressors, 75 kw. a.c. generator, ammonia condensers, receivers, pumps, hoists, motors, absorbers, generators, valves and fittings. Must dismantle at once. Capital Ice Refrigerating Co., Indianapolis, Ind.

One International Truck with Allis-Chalmers swabbing machine for swabbing and tubing and rod pulling.

Two 1000-barrel steel storage tanks.

One O.C.S. cable tool unit with steel bull wheel, 12x12 Ajax steam engine and 60 horsepower boiler.

C. C. Hogue, 204 Ward Building, Shreveport, Louisiana.

NOTICE OF SALE

■ The City of Newell, S. Dak., will receive sealed bids until 7:30 P.M. of December 28, 1942, for the following property: One No. D T 1210 Complete Ideco Pumper Unit; Approximately 2400 feet ¾ inch Norris Galvanized Sucker Rods; One 13-35 Variable Speed Electric Motor. Specifications may be obtained by writing G. Martin Berg, City Auditor, Newell, S. D.

WANTED TO BUY

■ Wanted to buy Marine Diesel Engines. What do you have to offer? INDUSTRIAL SUPPLY & EQUIP. CO., INC., 338 Baronne St., New Orleans, La. Raymond 0889.

SEISMOGRAPH

■ Large Company wants men between the ages of 18 and 40 for non-technical and for technical positions on Seismograph Field Parties. Men without technical education or experience in this or similar work start at $140.00 per month. Others start at higher salaries. For interview write giving experience, education, and other pertinent facts. Those liable for early induction or who are employed in prime war industries need not apply. Write Box 138, Oil Weekly, Houston, Texas.

ADVERTISING RATES

TRADING POST SECTION

Regular classified advertisements for this special section, set in type this size without border, take flat rate of 7 cents per word for the first insertion and 5 cents per word for each subsequent insertion of same copy. Display advertisements for this section, set in suitably larger type with ruled border, are $5.00 per inch for first insertion and $4.00 per inch for subsequent insertions. Remittance must accompany copy which should be sent to:

Trading Post Section, THE OIL WEEKLY
P. O. Box 2608 Houston, Texas

son 5-52, 880 ft from s and 1980 ft from e PSL 52, blk AX, flow 1286 bbls 2-in, acid 6000 gals 4890-4975 ft.

Mabee O&G Co.'s Willard 2-40, c ne nw PSL 40, blk AX, flow 729 bbls 2-in, acid 12,500 gals 4990-5040 ft.

Hockley County—Slaughter: L. M. Glasco & R. M. Hutchins' Mallet 2-C, lab 24, leag 47, Edwards CSL, flow 768 bbls cas, acid 12,000 gals 4915-67 ft.

Howard County: Fleming Oil Co.'s Dodge 9, 2100 ft from s and 580 ft from w lines T&P 15, blk 30, T-1-S, pump 200 bbls, shot 570 qts 2731-2828 ft acid 2000 gals, td 2873 ft.

Pecos County—Chancellor: Pure Oil Co.'s Odneal 1, c nw nw T&P 42, blk 49, Tsp 10, elev 3280 ft, Delaware lime 5056 ft, sand 5082 ft, shot twice, abnd 5293 ft.

Pecos County—White-Baker: Cardinal Oil Co.'s White-Baker 2-L, 1609 ft from n and 1650 ft from e lines GC&SF 90, blk 194, flow 108 bbls 1-in, shot 60 qts 1908-28 ft.

Upton County—McCamey: Trebol Oil Co.'s Ricker 1-B, 1320 ft from se and 1155 ft from ne lines sec 6, blk R, E. C. Grooms sur, pump 251 bbls, acid 1500 gals 2355-2410 ft.

Youkum County—Wasson: Belfort Oil Co.'s Herd-Humble 3, c se ne sec 795, flow 64 bbls, plus 13 percent water, ¼-in, acid 9000 gals 5015-5130 ft.

WEST TEXAS OLD WELL DEEPENED

Pecos County—Abell: Stanolind's Simmons 1, SWc lot 12, H&GN 26, blk 9, otd 5455 ft, flow 30 bbls 1/8-in, perf 5445-50 ft, td 5482 ft, pb to 5469 ft.

WEST TEXAS WILDCAT COMPLETIONS

Crane County—Failure: Gulf's Dawson 1-A, c s½ w¼ H&TC 10, blk 6, elev 2348 ft, anhydrite 1038 ft, San Andres 2090 ft, base Permian 5070 ft, top Simpson 5160 ft, Ellenburger 5305 ft, abnd 5505 ft.

Crockett County — Failure: J. S. Pittman-Geo. Atkins' Cox-Humble 1, 891 ft from se and 878 ft from sw lines M. Carnam sur No. 12, elev 2238 ft, top lime 1447 ft, abnd sul w 1755-57 ft.

Scurry County—Failure: Col-Tex Ref. Co.'s Wilson 1, c sw ne H&TC 174, blk 97, elev 2379 ft, top San Andres 1610 ft, abnd 4010 ft.

North Texas

Bend Lime Discoveries In Clay and Jack Counties

Clay and Jack counties have Bend lime discoveries pending. Shot collapsed pipe in Archer County prospect.

Clay County: Roy Lee, trustee's Maddox-Shell 1, 8 miles northwest of Ringgold pool and offset to a wildcat that was junked while trying to test, awaiting test of Ellenburger at 5587-5672 ft with 5½-in at 5560 ft. If non-productive will perforate broken saturation in Bend at 5471-82 ft and porous lime at 5482-5504 ft, as 20-minute drill-stem test at 5470-5528 ft yielded 108 ft of oil- and gas-cut mud. Youngblood & Foree's Sanzenbacher-Gulf 1, wildcat that has indicated small producer from Mississippian perforations at 5994-6096 ft, is installing pumping unit.

Jack County: Hanlon & Buchanan, Inc.'s, Ellis & DuBose 1, Lot 6, J. W. Williams Sruvey, 6 miles south of Antelope, cemented 5½-in on top of Bend at 4785 ft after coring favorable oil saturation to 4798 ft. The customary drill-stem test was not made on the strength of the oil content of the cores. Youngblood & Foree's Cherryholmes 1, G&BN 3, 10 miles northeast of Jacksboro, was drilling sand at 5260 ft, having logged nominal oil show at 5242-47 ft in sand phase of Bend, topped at 4940 ft; and Clayton 1, 6 miles southwest of Perrin, was drilling lime at 5180 ft. Joe Worsham et al's Meador 1-a, twin to a 5277-ft junked producer, was drilling dry lime at 4915 ft. Barnsdall-Youngblood & Foree's Garrison 1, Thomas Nash Survey, was drilling lime and shale at 5095 ft.

Archer County: Whitaker Oil Co.'s Coleman 1, 3 miles northeast of Scotland pool, collapsed pipe after 30-quart nitro shot in Strawn saturation 3696-3712 ft, total depth 3721 ft. Operations suspended to await outcome of Coleman 2, west offset, drilling at 1730 ft.

Montague County: Continental's Heard 1, southwest offset to its Stoneburg pool discovery, filled 125 ft with oil from upper Bend pay at 5988-6008 ft, developed collapsed pipe after acidizing with 5000 gallons. Discovery logged main pay at 6233-41 ft. Sinclair Prairie's Zachary 1, east outpost for Sanders pool and a failure in the 5900-ft Bend, promises to give the area its first Strawn production through having yielded 118 bbls of oil and 242 bbls of water on 24-hr swabbing test from perforations at 4788-4808 ft.

NORTH TEXAS FIELD COMPLETIONS

Archer County—Scotland: Shell's Coleman 5-G-C, 330 ft from n and 990 ft from w lines lot 2, ATNCL 74, Bend 5152 ft, Miss. 5602 ft, flow 1504 bbls, 5/16-in, acid 1000 gals, perf 5152-90 ft, td 5660 ft.

Clay County: Metzner & Gorman's Taylor-Riley 1, 990 ft from nw and sw lines s-200 ac sec 35, J. Duncan sur A-112, abnd 1180 ft.

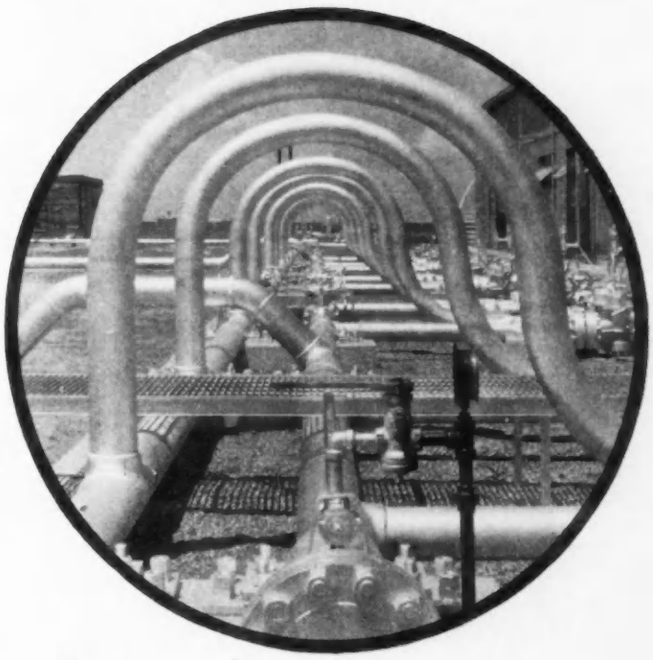
Metzner & Gorman's Taylor-Riley 2, 1980 ft from nw and sw lines of s-200 ac sec 35, J. Duncan sur, abnd 1325 ft.

J. C. Barnard et al's Hansard 1, 330 ft from ne and se lines of nw-25 ac of lot 1, Thornberry subdiv, pump 15 bbls, sand 1125-35 ft, td 1141 ft.

Montague County—Forestburg: Magnolia's Medley 1, 467 ft from nw and ne lines 90.58-ac lse, G. W. Fanning sur, Bend 6645 ft, Marble Falls 7082 ft, pump 35 bbls oil, plus 17 bbls water, acid 7226-7444 ft, td 7476 ft.

Montague County—Bowers (Benton-Holmes): Rogers Bros. Dr. Co.'s Schenk 1, 1901 ft from s and 330 ft from w lines sec 24, S. Dunham sur, abnd in granite 3428-39 ft.

Wilbarger County: Phillips' Waggoner Est.



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ONE OF THE NATION'S 100 LARGEST BANKS

9-OO, H&TC 45, blk 4, pump 46 bbls, plus 19 bbls water, shot 40 qts 1882-1900 ft.

NORTH TEXAS GAS INPUT WELL

Archer County: Producers Development Co.'s Roach 11, 1663 ft from w and 750 ft from n lines TE&L 1595 ft, sand 1261-74 ft.

NORTH TEXAS WILDCAT STARTS

Jack County: Jim Seeds et al's (was E. G. Christie) N. W. Davis 1, 2795 ft w and 2065 ft n of m/s/se corner BBB&C A-94, otd 2960 ft, co to deepen.

Montague County: Rogers Bros. Dr. Co.'s E. S. Hoffman 1, 660 ft out sec Thos. Puckett sur A-607, dr 1420 ft.

NORTH TEXAS WILDCAT COMPLETIONS

Clay County—Failure: Continental's Spring 6, 532 ft from n and 3051 ft from e lines sec 26, but in sec 25, Marion CSL sur, top Bend 5948 ft, Simpson 6142 ft, abnd 6262 ft.

Jack County—Failure: Standard of Texas-Hanlon-Buchanan's Gowdy 1-A, 1980 ft from e and 660 ft from s lines n-520 ac TC 2, Bend 5026 ft, jkd and abnd 5126 ft.

TEXAS PANHANDLE FIELD COMPLETIONS

Carson County: Cities Service's Bennett 2, 2535 ft out of nwc H&GN 16, blk S, 101,000,000 gas open, 364 lbs rp, lime 2625-2735 ft.

Gray County: Phillips' Davidson-Rieger 2, 330 ft from n and 900 ft from e lines nw H&GN 64, blk B-2, pump 139 bbls, shot 280 qts 2935-3007 ft, td 3021 ft.

Phillips' Willis 1, se se nw H&GN 191, blk B-2, 42,500,000 gas open, acid 5000 gals 2767-2863 ft.

Hutchinson County: Gray County Prod. Co.'s (was Sand Creek Oil Co.) Jasper 4, 330 ft out nwc w-100 of ne-221 ac TC 23, blk M-23, pump 40 bbls, acid 3000 gals, 3065-3175 ft.

Phillips' Stewart (Walter) 2, e se ne AB&M 19, blk M-16, pump 270 bbls, shot 180 qts 3194-3240 ft, td 3242 ft.

Moore County: Phillips' Coon-Stan 1, 2495 ft out nwc H&TC 233, blk 44, 14,500,000 gas, 400 lbs rp, lime 2880-3280 ft, td 3330 ft.

Phillips' Kelly-Keil 1, c HT&B 242, blk 3-T, 51,500,000 gas, acid 5000 gals 2860-3175 ft, td 3210 ft.

WEST CENTRAL TEXAS FIELD COMPLETIONS

Jones County—Akard: T.P. Coal & Oil Co.'s Stokes 1-A, 459 ft from s and 560 ft from w lines 57-ac lse, G. Martinez sur, flow 116 bbls, 2-in, natural, 2124-36 ft.

Shackelford County: J. W. Keys et al's Andrews 2, ET 14, abnd 802 ft.

W. M. Reed et al's Trice 1, 1675 ft from se and 160 ft from sw lines TE&L 817, abnd 770 ft.

Taylor County—Reddin: Butler-Horne Dr. Co.-Geochemical Surveys' Hudson 3, 380 ft from w and 650 ft from s lines lot 3, J. A. Nabors sur, elev 1779 ft, junked 2519 ft.

Butler-Horne-Geochemical Surveys' Reddin 2-A, 400 ft from s and 580 ft from e lines lot 4, J. A. Nabors sur, elev 1778 ft, abnd 2563 ft.

WEST CENTRAL TEXAS WILDCAT COMPLETIONS

Shackelford County— Failure: O. E. Schkade et al's Schkade 1, 1536 ft from se and 330 ft from ne lines TE&L 570, abnd 930 ft.

Parker County—Failure: Walter K. Jones et al's Stevens 1, 660 ft out NEc T&P 172, abnd 915 ft.

Parker County—Gas Discovery: Walter K. Jones et al's Darnell 1, 660 ft out NWc T&P 173, elev 1180 ft, top Barnett 5500 ft, Ellenburger 6078 ft, 890,000 gas, acid 2000 gals perf 2805-25 & 3214-40 ft, td 6126 ft.

East Texas

Franklin County Test Will Explore Trinity

Trinity prospect assigned Franklin County. Unit development slated for Tri-Cities pool. Nacogdoches County wildcat cased for production test.

Franklin County: Tide Water and Seaboard's Bacon 1, northeast corner of 123-acre tract, John Maxmillin survey, will explore geophysical prospect in southeast corner of County for Lower Trinity production. Area involves structural conditions similar to the nearby Travis Peak oil pool near Pittsburg.

Henderson County: Stanolind's Tricities Unit (Wentz) B, involving 750-acre unit, will seek north extension for Tricities Oil pool, which produces from the Rodessa section.

Nacogdoches County: The Texas Co.'s Strahan 1, wildcat that showed gas possibilities in Travis Peak, topped 8615 ft. Cemented 5-in 9054 ft to test broken porosity logged at intervals to 9295 ft. Then perforate opposite upper Travis Peak.

Bowie County: Bowlen et al's Simms 1, projected Smackover lime test, was drilling at 8575 ft in red shale, topped at 8400 ft and above Buckner.

Wildcats: Magnolia's McCreight 1, 3½ miles northwest of recent Paluxy discovery on Quitman prospect, failed to recover parted drill pipe and abandoned at 6665 ft. Tested water in Paluxy, topped at 6305 ft. In Kaufman County, Carter et al's Stanfield 1 was standing at 3595 ft, being dry in Paluxy and Glenrose, topped at 3375 ft and 3555 ft, respectively. Zephyr Oil Co.'s Peeples 2-B, second deep test for Tehuacana pool, Limestone County, was idle at 5046 ft.

EAST TEXAS FIELD COMPLETIONS

Wood County—Hawkins: Humble's LaForce 1-B, 450 ft from s and 360 ft from e lines Willis Parker sur, top Woodbine 3990 ft, Georgetown 4503 ft, abnd 4530 ft.

Paul L. Miller et al's Faulk 1, center 1½-ac lse, Geo. Brewer sur, top Woodbine 4502 ft, flow 469 bbls ¼-in, perf 4602-12 and 4646-52 ft, td 4820 ft.

EAST TEXAS WILDCAT COMPLETIONS

Ellis County—Failure: J. B. Stoddard et al's Smith-Texaco 1, 1550 ft from sw and 660 ft from nw lines of J. B. Edwards sur, elev 480 ft, top Woodbine 1585 ft, Buda 1985 ft, Georgetown 2130 ft, Goodland 2687 ft, 1st anhydrite 3490-3580 ft, top Travis Peak 4450 ft, quartzite 4879 ft, abnd 5020 ft with 60 degree formation dip.

Limestone County—Failure: Peyton Bros.' Thompson 1, 665 ft from ne and 750 ft from nw lines 65¾-ac lse, Pedro Varela sur, elev 548 ft, Austin 2100-2810 ft, abnd 3700 ft.

Van Zandt County—Failure: O. W. Killam et al's Wages 1, 660 ft from s and 990 ft from e lines 175-ac tr, Daniel Chesser sur, elev 484 ft, Pecan chalk 2325-2435 ft, Austin 3243-3685 ft, top Woodbine 4181 ft, Georgetown 4930 ft, abnd 4955 ft.

Wood County — Failure: Magnolia's Mc-

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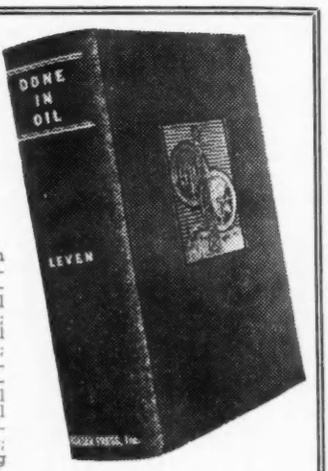

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Creight 1, 660 ft out nwc 87.7-ac tr, lot 7, E. Esparza sur, elev 423 ft, Austin 3965-4015 ft, top Woodbine 4458 ft, Georgetown 5167 or 5195 ft, Goodland 6248-90 ft, Paluxy 6305 ft, jkd and abnd 6665 ft.

EAST TEXAS WILDCAT STARTS

Angelina County: K. L. McHenry et al's Long Bell 1, 658 ft from sw and 3491 ft from se lines 503-ac tr, P. Mullins sur, 3 mi s Ivy, lcn 5000-ft Wilcox test.

Dallas County: J. F. Lucey and S. A. Guiberson, Jr.'s Moyer-Texaco 1, 1980 ft ne of sw and 660 ft se of nw lines 198.3-ac tr, Thos. Johnson sur 678, 4 mi e by n Ferris, mim for Smackover lime test.

Upshur County: Blackwell O&G Co.'s Briggs 1, blk 55, 3250 ft from e and 5650 ft from s lines J. B. B. Davenport sur, Austin chalk 3680-3714 ft, coring 3740 ft.

Southwest Texas

Bee County Wildcat Testing in Vicksburg

Discovery at Tynan in Bee County is testing Vicksburg. Gulf is testing large sand section in Refugio area wildcat.

Bee County: Stanolind's Ulke 1, four miles northwest of Tynan, has been flowing 23 gravity oil with some water from perforations in Vicksburg at 4212-23 ft after coring sand at 4197-4230 ft. Perforations will be made higher in hole in effort to shut off water. A drill stem test at 4210-12 ft recovered 715 ft of oil and small amount of brackish water. This well is a prospective field opener in northerly north corner of Hiram H. Williams sur, southwestern part of county.

Refugio County: Gulf is testing a large section in Vicksburg in Tatton 2, wildcat 3 miles southeast of Tomoconnor field and one mile east of Copano Creek field. Perforations have been made at 8460-90 ft, 8400-30 ft, 8265-80 ft, all in Vicksburg. Perforations at 8460-80 ft tested gas and distillate, while perforations at 7998-8012 ft yielded salt water from Basal Frio. This wildcat is in Mrs. Essey Reed survey, abstract 251.

Wildcats: Stanolind has staked Shawe 1, one mile south of Berclair in Bee County, which will test Wilcox. It is in William Ryan survey, south of Blanco Creek, and is two miles southeast of Magnolia's Buck 1, deep well which yielded gas and distillate from perforations at 10,370-404 ft and 10,020-150 ft. This latter well was shut in as a non-producer.

Stanolind also has projected Henry 1, a 6500-ft Wilcox test in north portion of McMullen County. It is on a 227-ac tract in William Kuykendall survey and is northwest of Tilden.

Nueces County: R. H. Hawn has reached contract depth in Bauer 1, wildcat in lot 8, block 6, M. L. de Herrera grant, two miles north of Robstown, and has run electrical survey and is now waiting on orders at 6000 ft. Sand and sandy shale carrying oil odor were cored at 5225-32 ft and at 5233-35 ft. Drill stem test failed to recover any oil.

LOWER TEXAS COAST FIELD COMPLETIONS

Jackson County — Stewart: W. Stewart Boyle's Meyer 2, 660 ft fr s&el's of east 80-ac tr of 160-ac tr, George Sutherland sur, 5½-in 6037 ft, abnd 6055 ft.

Jackson County—West Mauritz: Gulfboard's Mauritz 1-A, 778 ft fr wl & 936 ft fr nl & 467 ft fr s&el's of 40-ac tr, M. L. York sur, A-22, 5½-in 5521 ft, sand 5451 ft, perf 5451-57 ft, 137 bbls, ⅛-in, td 5587 ft.

Jackson County—Ganado: Texas Co.'s Simicek 3, 1397 ft fr wl & 467 ft fr nl of 165-ac lse, M. L. York sur, A-12, 5½-in 5494 ft, sand 5430 ft, perf 5430-36 ft, 152 bbls, ⅛-in, td 5540 ft.

Jim Wells County—Seeligson: Magnolia's Seeligson 33, 660 ft fr el & 4620 ft fr sl of Los Jaboncillos gr, sand 5902 ft, 7-in 5950 ft, perf 5902-08 ft, 97 bbls, 7/64-in, td 5950 ft.

Kleberg County—Stratton: Humble's King Ranch-Paso Ancho 22, 660 ft e fr wl of 1350-ac tr, King Ranch lse, Paso Ancho de Abajo gr, 5½-in 6570 ft, sand 6555 ft, flow 66 bbls, 5/64-in, td 6604 ft.

San Patricio County — Midway: British-American's Mullen 4, 660 ft fr sel & swl of 160-ac lse, SA&MG 6, 5½-in 6115 ft, sand 6070 ft, perf 6073-76 ft, 148 bbls, ⅛-in, td 6511 ft.

LOWER TEXAS COAST WILDCAT COMPLETIONS

Jim Wells County—Discovery: H. R. Smith and H. J. Mosser's Roth 1, 467 ft fr n&wl's tr 83, George J. Reynolds sur 126, 2½ mi sw Orange Grove, abnd at 5405 ft, January, 1941, washed down and set 4½-in 3522 ft, perf 3245-75 ft, 30,000,000 cf gas ⅛-in, td 5405 ft.

Refugio County—Failure: Bridwell Oil Co.'s Wood 1, 660 ft fr n&wl's of share 7, John Sinnott sur, A-67, Greta sand 3650 ft, abnd 3900 ft.

LOWER TEXAS COAST WILDCAT STARTS

Jackson County: Humble's Isaacson 1, 565 ft fr se & 2175 ft fr swl of 106-ac lse, Carlos Lasso sur, lcn 8000-ft test.

Jim Wells County: Southern Minerals' Hawkins Est. 1, San Diego area, 11,215 ft n alg wl fr sw cor Hawkins & Willis Rch, thence 4086 ft e at ra to lcn, San Diego de Abajo gr, A-135, lcn.

Refugio County: Bridwell's Glover 1, 660 ft fr nw & nel 369-ac lse, John Sinnott sur, A-68, lcn 6000-ft test.

OLD WELL DEEPENED

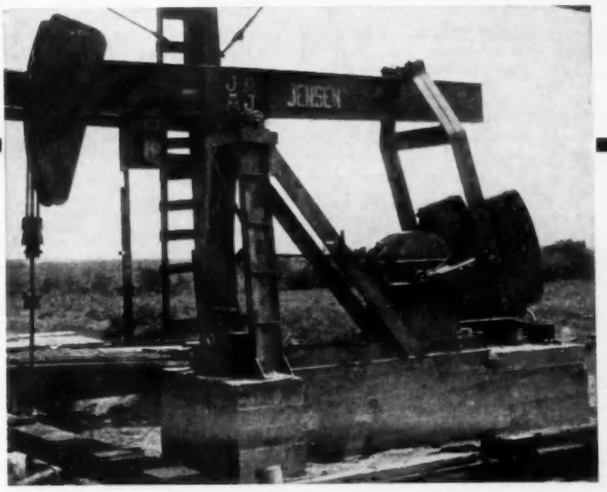
Jim Wells County—Seeligson: Sun's Canales 2, 2660 ft fr nl & 1850 ft fr wl A. Canales sur 182, old td 5210 ft, deepened to 5560 ft, 5½-in 5210 ft & 407 ft of 4-in liner to 5560 ft, perf 5470-74 ft, 3,400,000 gas open flow, td 5560 ft.

SOUTHWEST TEXAS FIELD COMPLETIONS

Duval County—Sejita: Standard of Texas' Leal 1, 1780 ft fr el & 1235 ft fr s'ly sl of 324-ac tr, blk 3, San Pedro de Charco Redondo gr, 5½-in 5890 ft, perf 5778½-80 ft, abnd 5895 ft sidetracked hole.

Jim Hogg County—Colorado: Humble's 2640 ft fr s'ly sl and 1485 ft fr s'ly el of 1091-ac tr, Las Moretas gr, 4½-in 3119 ft, sand 3132 ft, flow 42 bbls, 3/16-in, td 3139 ft.

Starr County—South LaReforma: Baldridge



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& King and Navarro's Guerra 2, 660 ft fr s'ly wl & 2335 ft fr s'ly sl 960-ac lse, Santa Cruz gr, abnd 6006 ft.

Starr County—North Sun: Sun's Laurel 1, 875 ft fr s'ly nl & 495 ft fr e'ly wl of 401-ac tr, La Sal Colorado gr, abnd 4621 ft.

SOUTHWEST TEXAS WILDCAT COMPLETION

Duval County—Failure: Argo Oil Corp.'s Scott 1, 660 ft fr nl & 1980 ft fr el of 157-ac tr, blk 30, E. Corkill sur 104, abnd 6543 ft.

SOUTH CENTRAL TEXAS FIELD COMPLETION

Caldwell County—Bee Creek: Ralph R. Ogden's Tally 18, 2577 ft se alg sw'ly nel of lse, 5½-in 2275 ft, acidized 2000 gals, pump 53 bbls, td 2290 ft.

Texas Gulf Coast

Plan Deep Test In Polk County

Wildcatting shows slight increase with four deep tests projected. Boling flank discovery due to be placed on pump.

Polk County: Humble has staked location for a 12,000-ft Wilcox wildcat test in North Livingston area, deepest well ever drilled in area if objective is reached. Well is Whitforth et al 1 on 320-acre tract in Augustine Viesca survey, Abstract 77. Footage places the test 1145 ft from southwest corner of lease, 10 miles southeast of Livingston townsite. Most fields in Polk County produce from Wilcox, Wilcox and Sparta production being opened recently at Livingston field.

Harris County: Two wildcats have been projected in Katy area, first being Stanolind's Patterson 1, three miles north of Katy production. Scheduled to be drilled to 7750 ft, the well is on 640-ac tr in J. M. Bennett survey, Abstract 286, Section 96. It is 660 ft from north and east lines of section. This test is regarded as a flank test, however, it is farther away from production than any previous well drilled. Ohio, Humble and Tide Water hold surrounding acreage.

Cities Service and Sun are preparing to drill Tucker 1, five miles northeast of Katy. The well is projected to 8000 ft and is in SW NW H&TC 30, Abstract 1388.

Chambers Coutny: Standard of Texas is preparing to drill a 10,000-ft wildcat on Smith Point prospect, location being State 1-136 in the bay. Footage places the test 600 ft fr northwesterly and northeasterly lines of tract 136, 1½ miles offshore at Smith Point.

Wharton County: Pan American is due to set up pumping equipment on Vineyard 1, discovery on north flank of Boling dome. This well originally flowed some oil from perforations at 3724-30 ft, but pressures were too low to keep up steady flow. Rig has been moved off already, preparatory to installation of pumping equipment. Well is bottomed at 4012 ft with 7-in casing set to 3769 ft.

TEXAS GULF COAST FIELD COMPLETIONS

Fort Bend County — Big Creek: Angle & Angle's Davis 1, 10-ac tr, B. Wickson sur 5, sand 3134 ft, perf 3134-44 ft, pump 119 bbls, td 3248 ft.

Hardin County — Sourlake: Earl C. Hankamer's McLean 1, 12-ac tr out of 45-ac lse, Stephen Jackson sur, abnd 3065 ft.

Harris County—Katy: Humble's Scherff 1, 1320 ft fr n & 1320 ft fr el sec 130, J. W. McCutcheon sur, 7-in 7454 ft, perf 7239-75 ft, 160 bbls condensate, ½-in, td 7600 ft.

Jefferson County—Stowell: Glenn H. McCarthy's Prox 1, 100-ac tr, lot 14, B. A. Vacocu lge, A-53, 5½-in 8750 ft, perf 8735-40 ft, squeezed & reperf 8726-32 ft, 325 bbls 9/64-in chk, td 8813 ft.

San Jacinto County—Mercy: Shell's Central Coal & Coke 4, 665 ft fr nw'ly line of J. Robinson sur, 5122 ft fr ne'ly line of sur-7⅝-in 8240 ft, sand 8246 ft, 171 bbls, 1/8-in, td 8271 ft.

TEXAS GULF COAST WILDCAT COMPLETIONS

Harris County — Failure: McDannald Oil Co.'s Fee-East Texas Oil 3, 80-ac tr, Victor Blanco sur, se Humble, abnd 4518 ft.

Matagorda County — Discovery: United North & South's Stoddard 7, 1189 ft e fr e'ly line of L. L. Lambert 64-ac lse, 3458-ac tr, sand 8107 ft, 5½-in 8160 ft, 243 bbls, 12/64-in, td 8598 ft.

Walker County—Failure: F. R. Jackson and B. B. Orr's Bishop 1, 213-ac tr, J. Wood sur, A-595, abnd 4058 ft.

TEXAS GULF COAST WILDCAT START

Brazos County: Phillips' Renchie 1, Millican area, 58-ac tr, William Devers sur, len 7700 ft test.

Louisiana Gulf Coast

Krotz Springs Wildcat Flowing Light Distillate

Test projected on east edge at Pine Prairie, Evangeline Parish. To rework discovery well at Bayou Couba.

Evangeline Parish: Pan American Production Co. has projected a test on south edge of Pine Prairie dome, Crowell Land & Mineral 1. Location is southerly from Mansaur 3, which recently extended production. Footage is 1671 ft south and 1675 ft west of northeast corner of 2-4s-1w on 20-acre tract. This well is farther from field production than any other well in the area, except the wells producing from the Sparta sand section.

Northwest of Ville Platte field, Evangeline Parish, Continental is spudding Jaubert Bros. 1. The wildcat, spotted in 26-3s-2e, is a deep test of the Wilcox, the sand that produces at Ville Platte.

St. Charles Parish: Gulf is preparing to re-work Delta Securities 1, wildcat discovery at Bayou Couba which was completed recently. Original perforations were made at 6536-42 ft and flowed 196 bbls through 9/64-in choke. The well was completed September 19, 1942, after drilling to 6917 ft in salt topped at 6890 ft. Gulf recently abandoned Delta 2, north of the discovery, at 6449 ft in salt.

Wildcatting: George Echols is credited with finding a sand section around 9100 ft in Kessler & Sternfels 1 on the east flank at Napoleonville, Assumption Parish, with indications of production. This well, located in Section 136-12s-14e, is due to be drilled considerably deeper. William Helis is drilling Armelise Planting, Section 17-12s-13e, southeast flank of this salt dome.

Locations: Sun has projected a deep test on Egan prospect in Acadia Parish. The test is Daily 1 and is 1980 ft w and 660 ft north of southeast corner of 164-acre tract in SW 31-9s-1w. This well is on an old prospect, but it is due to be deepest test ever drilled in area.

A Wilcox test has been projected in Livingston Parish, an area that has not drawn much activity recently. It is Danciger and William Helis' McGreevy 1, 960 ft west NE NE 1-8s-6e. Drilling is due to start soon and will be a deep test for the area.

St. Landry Parish: Gulf is opening a new gas and distillate field on Krotz Springs prospect in St. Landry Parish with Haas-Hirsch 1 flowing 204 barrels of high-gravity distillate through

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various size chokes with high casing and tubing pressures. Production is from a sand around 9350 feet, believed to be below the basal Miocene. Gulf controls most of the acreage in the area. The hole is bottomed at 11,398 ft with casing set to 10,027 ft.

SOUTH LOUISIANA FIELD COMPLETIONS

Iberville Parish—Bayou Blue: Union Sulphur's Schwing 6, c 67-9s-11e, 5½-in 6939 ft, perf 6512-32 ft, 175 bbls 11/64-in, td 6939 ft.

St. Charles Parish—Paradis: Texas Co.'s LLE-Paradis 31, 2056 ft s, 694 e nec sec 8 in 30-14s-20e, 7-in 10,354 ft, perf 10,170-202 ft, 211 bbls, ¼-in, td 10,354 ft.

Texas Co.'s Singleton 1, 3231 ft s, 3613 e nec 8 in 38-14s-20e, perf 10,232-50 ft, 275 bbls, 9/64-in, td 10,400 ft.

Vermilion Parish—Whitelake: Union's Louisiana Furs 6-A, start nw cor sec 15, go 00 deg 34 mins w 3300 ft, thence s 89 deg 25 mins e 510 ft to lcn in sec 15-15s-1e, 5½-in 6878 ft, perf 6808-13 ft, 192 bbls, 5/32-in, td 8561 ft.

SOUTH LOUISIANA WILDCAT STARTS

Acadia Parish: Sun's Dailey 1, Egan prospect, 7 mi w Crowley, 1980 ft w, 660 n sec 31-9s-1w, lcn.

Livingston Parish: Danciger & William Helis' McGreevy 1, 960 ft w, 189 s nec 1-8s-6e, lcn.

North Louisiana

Second Manifest Test Is Abandoned

Second test at Manifest, Catahoula Parish, fails. Claiborne Parish wildcat nears projected depth, another to prospect deeper levels. Tensas Parish test to seek Midway formation.

Catahoula Parish: Eugene Jordan's Womack 1, SE 40-9n-5e will be abandoned. Porosity in Sparta at this, the second test in the Manifest area was not sufficient to warrant further production efforts when hole was bottomed at 1756 ft. Jordan's discovery, Louisiana Central 1, C NE SE 22-9n-5e, drilled to 4555 ft, depth of Wilcox in the area, plugged back to Sparta sand, perforated at 1811-18 ft and was put on the beam for 72 bbls of 19-gravity oil in 8-hr test.

H. L. Hunt is drilling Louisiana Central 1, wildcat, NE NW 19-9n-6e, to test Wilcox horizon, two miles east of the Sparta discovery.

Claiborne Parish: Sylvestre's Meadows 1, NE SW 23-22n-7w, 4 miles southeast of Haynesville production, has reported no shows of importance during drilling and wildcat is below 5564 ft nearing 6000-ft, projected depth.

Gulf's Miller 1, C NE NE 14-20n-8w, three miles south of Homer field, is preparing to drill deeper. Present depth at Miller 1 is 9126 ft, no shows reported.

Tensas Parish: Continental's Trimble et al 1, SW SW NW 18-14n-12e, drilling below 3700 ft, will prospect through Wilcox to projected 5000 ft to top Midway horizon approximately at that depth.

NORTH LOUISIANA FIELD COMPLETIONS

Caddo Parish—Pine Island: Bayou State Oil Corp.'s Brown 53, 27-20n-16w, abnd 1010 ft.

A Paul Gilbert's Pickens 1, 35-22n-16w, abnd 2531 ft.

Claiborne Parish—Haynesville: Sylvestre's Winn 2, sw se 26-23n-8w, swab 286 bbls, 22 hrs, Pettit lime, 14/64 in, cp 0, tp 100, gr 41, td 5608 ft.

Cook's Beckett est 1, ne nw 2-23n-8w, flow 45 bbls hr, Pettit lime, ⅛ in, cp 900, tp 300, 4000 gals acid, td 5406 ft.

Midstates' L. L. Sherman 1, flow 16.5 bbls hr, Pettit lime, 20/64 in, cp 650, tp 75, 5000 gals acid, td 5420 ft.

Concordia Parish—Lake St. John: California Co.'s Applegate A-3, 13-9n-10e, 32 bbls, td 4690 ft.

NORTH LOUISIANA WILDCAT COMPLETION

Caddo Parish: Roy Fisher's Scott 1, 474 ft s and 1300 ft e 8-16n-16w, abnd 6305 ft.

NORTH LOUISIANA WILDCAT STARTS

Bienville Parish: Placid's Nebo Oil Co. A-1, c sw ne 11-15n-7w, dr.

Bossier Parish: Hunt's Nebo Oil Co. 2, c sw sw 3-23n-12w, dr.

Hunt's J. F. Oglee 1, c ne ne 10-23n-12w, dr.

Caddo Parish: Harris & Owen's Fuller 1, c se ne 4-22n-15w, mim.

Catahoula Parish: Hunt's Louisiana Central 1, ne nw 19-9n-6e, dr.

Caldwell Parish: Placid's Louisiana Central 120, c nw sw 9-11n-3e, woc.

Morehouse Parish: Merren's Bonner 1, c nw nw 23-22n-7e, dr.

Union Parish: Hunt's Frost 1, c sw ne 18-23n-1e, dr.

Red River Parish: O'Meara's Franklin Realty Co. 1, ne sw 24-11n-10w, mir.

ARKANSAS FIELD COMPLETIONS

Columbia County—Dorcheat: Carter's Kirkpatrick 1, sw 13-18s-22w, perf Cotton Valley 7856-65 ft, flow 78 bbls, ¼ in; perf Smackover 8880-8912 ft, flow 30 bbls, ¼ in 4 hrs, tp 1650, td 9000 ft.

Columbia County — Macedonia: Vaughn's Jameson-Snider, nw 20-18s-21w, shut in awaiting test, td 8947 ft.

Union County—New London: C. H. Lyon's Agerton 1, c sw sw 12-18s-12w, pump 153 bbls, perf 5738-52 ft, td 6134 ft.

ARKANSAS WILDCAT COMPLETION

Bradley County: Placid's Murphy 1, c ne se 3-16s-10w, abnd 5409 ft.

ARKANSAS WILDCAT STARTS

Bradley County: Placid's Murphy 2, c se se 28-15s-10w, dr.

Placid's Murphy 3, c sw sw 16-17s-10w, dr.

Calhoun County: Placid's Freeman-Smith 2, c nw nw 12-15s-14w, sd.

Placid's Freeman-Smith 3, ne se 14-16s-13w, sd.

Columbia County: Roy Lee et al's Pickler 2, ne sw 23-17s-21w, dr.

Hunt's Pinewood's A-1, c se nw 9-20s-22w, spud.

Nevada County: Hunt's Kirk 1, c nw se 33-12s-20w, fish.

Hunt's Stamps Land 1, c nw nw 35-14s-23w, dr.

Union County: Carter Oil Co.'s Foyil 1, c nw nw 12-19s-15w, dr.

Fohs, Pilgrim and Root's Grace 1, nw se 31-17s-14w, dr.

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TRADING POST SECTION
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Mississippi

Adams County Wildcat Finds Deep Saturation

Adams County wildcat finds saturation in deep horizon. Pickens-Sharpsburg extended. Simpson County deep test quits.

Adams County: Saturation reported in 28 ft broken sand section in 90-ft core operation at 10,350-10,440-ft at Pure Oil Co.'s McDowell 1, SE SE 1-6n-4w. Casing is reported to be on the spot for production test. At 10,505 ft McDowell 1 halted. Operators have recovered all but 264 ft of total 1730 ft of drill stem stuck at bottom of hole.

McDowell 1, wildcat, is 4 miles southwest of Natchez and approximately 12 miles south of Lake St. John production where tests have encountered gas and distillate show around 10,000-ft horizon, although general production at Lake St. John is from 3400-ft horizon from Wilcox.

Pickens-Sharpsburg: Carter Oil Co.'s Cook 1, C NE NE 5-11n-3e, a southwest quarter mile extension for field, showed no tendency to flow in early test and operators are swabbing the well for recovery of 12 barrels per hour averaging 50 percent oil and 50 percent water from perforations in Wilburn sand at 4823-27 ft and 4830-33 ft.

Location clearance is under way for Carter to drill Bridgeforth 2, C NW SE 32-12n-3e.

Simpson County: Gulf Refining Co. stopped drilling in red shale at 10,407 ft and operators are dismantling rig preparing to abandon Wilbe 3, NE NE 5-2n-4e.

MISSISSIPPI WILDCAT STARTS

Clarke County: Harry Elliott's Long-Bell 1, 24-4n-16e, mim.
Claiborne County: Amerada's Roney 1, 66-11n-2w, lcn.
Sharkey County: Texas Co.'s Linzey 1, 19-13n-5w, lcn.
Hunt's Cameron 1, 6-13n-6w, dr.
Issaquena County: Frontier's Mann 1, 24-11n-8w, dr.
Hunt's Delaney 1, 26-13n-8w, lcn.
John Allen's Stock & Walker 1, 29-13n-8w, lcn.
Madison County: Love Petroleum Co.'s Jones 1, 19-9n-1e, mim.
Simpson County: Carter's Allison 1, 17-1n-4e, dr.

Michigan

Dorr Field Has Heavy Oil Show in Monroe

First Monroe lime test in Dorr field, Allegan County, logs black oil show at 3030-38 ft. Saginaw County wildcat may get production test to Dundee lime show.

Allegan County: Muskegon Oil Corp.'s Podurigel 1, SW NW SE 29-4n-12w, first deep well in Dorr field, carried good showing 18-gravity oil in Monroe lime between 3030 and 3038 ft. Operators planned to drill ahead, at least 200 ft, before making a production test. Dorr field developed in 1938 for 1400-ft. Traverse production.

Saginaw County — Wildcat: H. C. Nelson's Butain 1, S½ NE SW 24-12n-1e, Jonesfield Township, logged Dundee at 3285 ft, and carried 100 ft of oil at 3289-99 ft. Water logged at 3300 ft and drilling halted at 3305 ft for orders.

Missaukee County—Aetna: First follow-up operation in Aetna Township, Gordon & Leonard's Reams 1, S½ SE SW 26-22n-6w, 2640 ft west of discovery, logged Traverse lime at 3143 ft, 15 ft higher than discovery, and carried good showing of gas and oil at 3170-80 ft. Water showed at 3212 to 3255 ft. Company now plans to drill to Dundee, about 600 ft deeper.

MICHIGAN FIELD COMPLETIONS

Arenac County — Adams: Ervin Major's Moore 2, c nw ne 27-19n-3e, Traverse lime, pump 18 bbls, 2100 ft.
Bay County—Kawkawlin: Gulf's Fontaine 1, n½ sw ne 33-15n-4e, Dundee lime, pump 33 bbls, 2943 ft.
Gulf's Paige 1, n½ sw nw 34-15n-4e, Dundee lime, pump 47 bbls, 2933 ft.
Isabella County—Deerfield: Osceola Transportation Co.'s Nicholson 1, nw sw ne 13-14n-6w, Stray sand, 400,000 ft gas, 1366 ft.
Isabella County—Vernon: Nollem Oil & Gas Corp.'s House 5, ne nw nw 26-16n-4w, Dundee lime, pump 25 bbls, 3743 ft.
Osceola County—Evart: Sun's Rohrer 1, n½ sw nw 26-18n-8w, Dundee lime, flow 73 bbls 3 hrs, 3701 ft.
Roscommon County—Headquarters: Mogul Oil Co.'s State A-2, n½ ne se 34-21n-3w, Traverse lime, flow 22 bbls, 3450 ft.
Van Buren County—Bangor: T. C. Hudson's Jackson 3, ne se se 20-2s-16w, Traverse lime, pump 30 bbls, 1007 ft.
Van Buren County—Bloomingdale: Donald Fredenhagen's Blust 1, c sw ne 15-1s-14w, Traverse lime, dry, 1324 ft.
Homrich & Kendall's Schock 1, sw ne nw 15-1s-14w, Traverse lime, dry, 1300 ft.

MICHIGAN WILDCAT COMPLETIONS

Ottawa County—Failure: Muskegon Dev. Co.'s Ottawa 1, ne sw sw 4-7n-14w, Traverse 1768 ft, td 1776 ft.
Van Buren County—Failure: Harris Oil Co.'s Copenhaver 1, sw nw ne 33-1s-16w, Traverse lime 1035 ft, 1061 ft.

MICHIGAN WILDCAT START

Osceola County: Ohio's Zimmerman 1, s½ ne se 28-18n-9w, rig.

California

Two Wildcats Quit, Three Are Starting

Wildcats abandoned in Kern, Sacramento and Riverside counties; new wildcat locations in Kern, Los Angeles and Sacramento counties. Madera County has gas discovery.

Kern County: General Petroleum Corp. has abandoned Bishop 1, wildcat located in 14-28-28, Southwest Round Mountain area, bottomed at 2990 ft in gray sand with spots of oil sand.

In the much-prospected Grapevine-Tejon Ranch area, T. W. Burnam has staked location for a new wildcat, Pancho 1, 35-12-18.

Los Angeles County: J. Paul Getty has added to already extensive holdings in San Fernando area, with location announced for a wildcat test named Foothill Orchards 1, to be drilled in 6-2-15.

Madera County: Texas Co.'s Gill 38-16, wildcat gas test in 16-13-16, Mendota area, on formation test 4419-4485 ft flowed gas at rate of 9,000,000 cu ft. The zone 4526-4575 ft tested wet.

Riverside County: In the San Jacinto area, Wonder Oil Co.'s Stroh 1 was abandoned in gray shale at 2801 ft.

Sacramento County: Independent Exploration Co. has staked location for gas test, Unit Plan 1, location falling in 8-7-6, Elk Grove area.

In Rio Vista area, Peter Cook Jr.'s No. 2, gas test in 7-4-3, after testing wet was abandoned at 4791 ft.

ARTHUR E. PARKER, 45, accountant of The Texas Company and an employe since serving with the Marine Corps in World War I, died December 18 of a heart attack while on duty in the company's Forth Worth division office.

CALIFORNIA FIELD COMPLETIONS

Fresno County—Coalinga Old Field: Standard's No. 64-3C, 1451 ft s, 741 w nec 3-20-15, pump 67 bbls 21-gr, 171 ft perf 3176 ft, td 3400 ft, pd 3180 ft.

Kern County — Belridge South: Belridge's No. 37A-34, 825 ft n, 1492 e swc 34-28-21, pump 35 bbls 17.7-gr, perfs 385-460, 518-759 ft, Diatomite 745 ft, td 759 ft.

Belridge's No. 46A-34, 1480 ft n, 2155 e swc 34-28-21, pump 50 bbls 16.8-gr, 780 ft.

Belridge's No. 28-3, 405 ft n, 145 e w¼c 3-29-21, pump 61 bbls 13.8-gr, perf 619-790, 879-929, 950-1017 ft, td 1025 ft.

Kern County—Buena Vista Hills: Standard's No. 53-35B, 650 ft n, 2520 w sec 35-21-23, pump 66 bbls 24.6-gr, 209 ft perf 3408 ft, td 3410 ft.

Kern County—Kern Front: Carrec Oil Co.'s No. 9, 235 ft n, 1980 w sec 11-28-27, pump 100 bbls, 181 ft perf 1861 ft, td 1915 ft, pd 1865 ft.

Westates Pet. Co.'s Cauley 39, 1410 ft s, 990 e nwc sw nw 16-28-27, pump 36 bbls 15.3-gr, perf 2661-2677, 2789-2800, 2840-2860 ft, top "M" zone 2514 ft, "N" 2840 ft, td 2951 ft.

Kern County — Midway-Sunset: Chanslor-Canfield's No. 46-9, 900 ft s, 1270 e w¼c, 9-32-23, pump 44 bbls 15.1-gr, 186 ft perf 1633 ft, oil sand 1313 ft, td 1670 ft.

Kern County—Poso Creek-Premier: Standard's No. 5-8, 330 ft s, 330 w nec 8-28-27, pump 35 bbls, 124 ft perf 2822 ft, td 2885 ft, pd 2815 ft.

Los Angeles County — Dominguez: Shell's Reyes 93, 1265 ft s, 3300 ft w c/1 Victoria and Wilmington Ave, flow 504 bbls 31-gr, 510/580 lbs, perf 7395-7156, 7121-6936 ft, 6925 ft, td 7573 ft, pd 7400 ft.

Los Angeles County—Montebello: Standard's Baldwin 95, 419 ft s, 1416 e nwc Sec 1, pump 139 bbls 13.1-gr, 458 ft perf 2933 ft, td 2935 ft.

Los Angeles County—Puente Hills-Turnbull Canyon: Continental's Turnbull Comm. 4, 798 ft nly along c/1 La Cuesta fr c/1 La Subida dr thence 371 ft wly at r/a, flow 290 bbls 26-gr, 81/64 in, 195/610 lbs, 546 ft perf 4068 ft, 4070 ft.

Los Angeles County — Wilmington: Long Beach Oil Dev. Co.'s "W" 33, 380 ft nely along n line Seaside Blvd fr e line 21st st thence 300 ft nely at r/a, pump 318 bbls 18-gr, 249 ft perf 3462 ft, td 3467 ft.

Texas' Refinery Fee 7, 875 ft s 360 ft e sec State and Goodrich Aves, pump 61 bbls 16.4-gr, perf 3370/3531 ft, td 3543 ft.

Orange County—Huntington Beach: Southwest Exploration Co.'s State 48, 269 ft n, 4214 w c/1 23rd st and Ocean, pump 272 bbls 23.7-gr, 608 ft perf 5352 ft, td 5352 ft.

CALIFORNIA WILDCAT COMPLETIONS

Kern County — Failure — McKittrick Area: McVee Associates' No. 1, 330 ft s, 330 e c 33-29-21, flow sulphur water, abnd 1137 ft.

Riverside County — Failure — San Jacinto Area: Wonder Oil Co.'s Stroh 1, 1033 ft n 688 ft w sec Lot 4 frac'l 30-4-1, abnd 2801 ft in gray shale.

Santa Barbara County — Failure — Goleta Area: Security Land & Royalty Co.'s No. 1, 1700 ft s, 300 e nw cor 12-4-34, abnd 3290 ft in Vaqueros gray sand.

CALIFORNIA WILDCAT STARTS

Kern County: Richfield's M. & K. Fee 1, 33-28-27, Kern Front area, lcn.

Tide Water Associated's De Pauli 78-19, 19-27-27, McVan area, lcn.

Di Giorgio Fruit Corp.'s Di Giorgio 2, 12-31-29, Mountain View area, lcn.

General Pet. Corp.'s Bishop 1, 6-29-29, Round Mountain area, lcn.

Eastern States

OHIO COMPLETIONS

Ashland County: H. B. Walker's Taylor 1, 250,000 gas, 1739 ft.

Kemrow Co.'s Reese 5, abnd 2871 ft.

Ohio Fuel's Hare 1, 848,000 gas, 2927 ft.

Gallia County: Portage Producers' Cambria Clay Prod. Co. 22, abnd 3020 ft.

Guernsey County: Roy Early's Tucker 1, abnd 1199 ft.

Ohio Fuel's Kennedy 1, 2,590,000 gas, 3215 ft.

Knox County: Upham Gas Co.'s Lower 3, 150,000 gas, 2764 ft.

Earley et al's Hammond 2, abnd 770 ft.

Lawrence County: Ohio Fuel's Moulton Tr. 2, 1,880,000 gas, 3121 ft.

Medina County: Ohio Fuel's Garbor 1, 970,000 gas, 3537 ft.

M. L. Packard et al's Crocker 17, 75 bbls, 462 ft.

H. C. Bishop's Lorenz 1, abnd 3308 ft.

Morgan County: Industrial Gas' Reeder 1, 800,000 gas, 4491 ft.

Industrial Gas' Diver 2, 2,900,000 gas, 4289 ft.

Noble County: Warren et al's Franklin 1, abnd 1708 ft.

Preston Oil Co.'s Jamison 1, 6 bbls, 1200 ft.

Perry County: Ohio Fuel's Coulter 2, abnd 4004 ft.

Pure's Ford 2, 68 bbls, 3284 ft.

Preston Oil's Pennington 2, 10 bbls, 3367 ft.

Ohio's Foucht 1, 700,000 gas, 2354 ft.

Washington County: G. F. Warren's Fee 2, abnd 582 ft.

Dolph Anderson et al's Greenlee 1, 500,000 gas, 1380 ft.

Wayne County: Ohio Fuel's Alleman 1, 1,250,000 gas and 7 bbls oil, 3284 ft.

Clark's Stauffer 1, 880,000 gas, 3170 ft.

PENNSYLVANIA COMPLETIONS

Clarion County: B. Burns et al's Males 1, 116,000 gas, 2750 ft.

Fayette County: Greensboro Gas Co.'s Barton 2, 7868 ft.

Indiana County: Equitable Gas Co.'s Daraigh 3279, 1194 ft.

T. W. Phillips' Helman 1, 474,000 gas, 1405 ft.

Apollo Gas Co.'s Armstrong 1, 1,100,000 gas, 1951 ft.

WEST VIRGINIA COMPLETIONS

Calhoun County: Everett Starcher et al's Roach 1, abnd 1847 ft.

McCall Drlg. Co.'s Cunningham 3, 8 bbls, 2326 ft.

Gilmer County: H. B. Scott's Crites 1, 2,500,000 gas, 1698 ft.

Pittsburgh & W. Va. Gas Co.'s Frost 7887, 60,000 gas, 1876 ft.

Jackson County: United Carbon Co.'s Winters 1068, 7,959,000 gas, 5165 ft.

Spartan Gas Co.'s Castro 2, 8,572,000 gas, 5034 ft.

United Fuel Gas Co.'s Elliott 5122, 3,810,000 gas, 5124 ft.

Lincoln County: Owens, Libby, Owens' Lincoln Land 1, 34,000 gas, 4840 ft.

David Gas Co.'s McNeely 1, 933 gas, 1789 ft.

Monongalia County: Mfgrs. Lt. & Heat Co.'s Henderson 3647, 125,000 gas, 3394 ft.

Putnam County: Teavee Oil & Gas Co.'s Forth & Erwin 2, 18,600 gas, 2592 ft.

R. H. Adkins' Tincher 1, 133,000 gas, 2402 ft.

Godfrey L. Cabot's Black Betsy Land Co. 1, 232,000 gas, 1690 ft.

Ritchie County: Moats & Barker's Davisson 1, 39,400 gas, 1960 ft.

F. S. Deem et al's Ritherford heirs 27, 20 bbls, 1825 ft.

Wood County: South Penn Natural Gas Co.'s McPherson 8, 2 bbls, 2293 ft.

Clifton Oil & Gas Co.'s Volcanic Oil & Gas Co. 4, 4 bbls, 1608 ft.

DRILLED DEEPER

Doddridge County: Hope Natural Gas Co.'s W. S. Haddox 4933, 440,000 gas, 2264 ft.

Wirt County: Ritcher Oil Co.'s M. Ritcher 14, 34,000 gas, 1964 ft.

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on page 52 of this issue

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Men in the Industry's News

E. A. WAHLSTROM, chief engineer of the Goldsmith Engineering Committee, has been given a leave of absence to accept a commission as lieutenant in the U. S. Naval Reserve. He will be succeeded by Eddie Griswold, engineer and independent operator. Wahlstrom has ably served Goldsmith operators for the past five years as chief engineer, and it was through his efforts that approval of the production unit plan for Goldsmith was granted by the Texas Railroad Commission.

The Goldsmith Engineering Committee also has selected an executive committee, composed of: Dewey A. Jordan, The Atlantic Refining Company, Midland, chairman; J. W. House, Humble Oil & Refining Company, Midland, secretary; M. L. Atkinson, Phillips Petroleum Company, Odessa; O. F. Hedrick, Texas Pacific Coal & Oil Company, Midland; R. R. Porterfield, Devonian Oil Company, Midland; G. A. Poole, Gulf Oil Corporation, Odessa; Paul Oles, Clifford Moers Company, Midland, and George Card, Stanolind Oil & Gas Company, Fort Worth. The committee will assist and advise the new chief engineer.

EDGAR A. WAITE will take charge of public relations activities of Standard Oil Company of California January 1.

For the past five years Waite has served as vice president of Braun & Company, public relations counsellors, Los Angeles. He was at one time associated with the Lord & Thomas and Benton & Bowles advertising agency, before which he was a newspaperman. His appointment creates a new position with Standard Oil Company of California and does not affect others now with the company.

W. ROY WIDDOES has been named director of personnel relations for Lukens Steel Company and its subsidiaries, Coatesville, Pennsylvania, succeeding Charles L. Huston, Jr., who was recently made assistant to the president of the company. At the time of his appointment, Widdoes was general manager of By-Products Steel Corporation, a Lukens subsidiary.

B. R. GOSSETT, Humble Oil and Refining Company assistant district superintendent, has been transferred from the Raccoon Bend district to the Lovell Lake district, Texas Gulf Coast.

DR. BLAINE B. WESCOTT, chief of the materials and products chemistry division of the Gulf Research and Development Company, Pittsburgh, has been appointed a member of the Sectional Committee on Pipe Threads of the American Standards Association. The scope of the committee covers the American (Briggs) Standard taper and straight pipe threads, plumbers' threads, threads for electrical conduit and threads for thin tubes.

BEACON DRILLING COMPANY, the new title of the company formerly known as Manahan Drilling Company, has moved its offices from the National Bank of Tulsa Building to the Philtower Building, Tulsa. George H. Lang has been named general manager and vice president. Eolin Trippe, Ada, is president and E. J. Bonner is secretary-treasurer.

STARK FOX, who has been associated with Oil Producers Agency of California for the past five years, and with the Conservation Committee of California Oil Producers for the past two and a half years, has been appointed a lieutenant, junior grade, United States Naval Reserve, and is reporting for training for administrative duties in the Navy's air arm.

HENRY J. MELCHERT, with offices at 122 South Michigan Avenue, Chicago, has been appointed distributor for Hamer Oil Tool Company in Illinois.

A. A. NICHOLSON, assistant to the vice president of The Texas Company, addressed a meeting of the company's employes in West Tulsa December 24 on "Your and the Company's Responsibility in the War Effort."

HENRY BOGGESS, safety engineer for Sinclair Prairie Oil Company, Tulsa, will speak to the Engineers Club of that city January 18 on Industrial Accident Prevention.

JERE IVY, safety engineer for Carter Oil Company, Tulsa, has succeeded J. D. McCamey, now in the Army Engineering Corps.

W. M. PICKLES, JR., engineer with Schlumberger Well Surveying Company, Houston, spoke at Tulsa, December 21 on the S. P. Dip Meter and its use in determining strike and dip of subsurface strata penetrated by the drill. The talk was before a joint meeting of AIME and Tulsa Geological Society.

ERIC L. FOHLER, Chicago consulting accountant recently serving with the War Production Board, has been appointed as executive officer of the PAW, it was announced December 23 by Deputy Administrator Ralph K. Davies. Fohler will serve as executive assistant to Davies in the handling of organizational and administrative problems.

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BEN H. RAVANELL, recently with Guiberson Diesel Engine Company as tool and research engineer and formerly with Oil Well Supply Company as service, sales and development engineer, is now connected with Continental Motors Corporation, Garland, Texas, as superintendent in charge of all assembly and test operations of tank engines which are built by this company.

G. F. DECK STEWART, vice president and general manager of the Stewart Oil Company, Mt. Pleasant, has been commissioned a captain in the army ordnance oil division. Stewart reported December 22.

KURT de COUSSER of Lansing, head of Socony-Vacuum Oil Company's Michigan land and geological division, was reelected president of the Oil and Gas Association of Michigan for 1943. de Cousser succeeded George W. Myers, Sun Oil Company, as association president a year ago.

The new board of directors also reelected all other officers of the association including James C. Graves of Saginaw, Goll-Graves-Mechling, Inc., vice president; George Talbot, Talbot Oil Company, and W. P. Clarke, Gulf Refining Company, both of Saginaw, co-treasurers; and W. B. Pardoe of Grand Rapids, Daper Oil Company, secretary. The board reappointed Harold H. McClure of Alma as association legislative secretary.

LEON C. GROSJEAN has announced he has accepted a position in the public relations field with the Talco Asphalt & Refining Company at Mt. Pleasant, Texas. Grosjean was former secretary of the Western Petroleum Refiners Association, with headquarters in Tulsa.

LEM PETERS, West Texas operator and former resident of Midland, has joined the Army Air Corps, and is on duty at Love field, Dallas, as flight dispatcher.

E. C. LANE, a chemist of the Bureau of Mines, died of a heart attack December 18 at his home in Bartlesville, Oklahoma. He was 62 years old and had been in the bureau service since 1919, first in the San Francisco laboratory and then (since 1924) at the Petroleum Experiment Station in Bartlesville. He was the author of a number of reports and other publications relating to the analysis of crude oils and gasolines and was considered a specialist in the analysis of crude petroleum.

Lane was born in Livermore Falls, Maine, September 30, 1880, and received his early education in the schools at that community. In 1904 he received his degree of A.B. in chemistry from Bates College in Lewiston, Maine, and in 1912 received a degree of Master of Science from the University of California.

Prior to coming to the Bureau of Mines he had a wide and varied experience both in teaching and in the industry. He taught chemistry in Pomona College, Claremont, California, and later spent two years in Changsha, China, where he taught chemistry in the college there. He also spent three years in Honolulu as a research and analytical chemist in the sugar industry. He was an active member of the American Chemical Society.

Squeaks from the Bull Wheel

Speed

"Have you been to the zoo?"

"No, sir."

"Well, you ought to go some time. You'd get a big kick out of watching the turtles zip past."

Still Looking

"That girl frankly admits she is looking for a husband."

"So am I."

"I thought you had one."

"So I have, and I spend most of my time looking for him."

Not Listed

"I took a walk through the cemetery today and read the inscriptions on the tombstones."

"Well, what about it?"

"Where are all the wicked people buried?"

Trying

"Jimmy is grand but I think all men are trying sometimes."

"All the time, dearie, all the time."

No Novelty to Him

The men had been going over the usual obstacle course swimming across a pool of dirty water, running up a bank, climbing a seven-foot wall, scrambling through bushes and barbed wire, and finally climbing a mountain.

The colonel shouted to one of the lads as he came to the end of this jaunt: "How do you like it, soldier?"

"Where I come from, sir, we have to go through country like this just to get to the barn."

Fleets In

"Today I met a girl who had never been kissed."

"I would like to meet her."

"You're too late now."

Cynic

"I know a girl who thinks her husband is simply wonderful."

"Ah, so you've just come from a wedding."

Definitions

A conference is a group of men who individually can do nothing, but as a group can meet and decide that nothing can be done.

A statistician is a man who draws a mathematically precise line from an unwarranted assumption to a foregone conclusion.

A professor is a man whose job it is to tell students how to solve the problems of life which he himself has tried to avoid by becoming a professor.

A psychologist is a man who spends his time trying to figure out whether we have more fun as children in our childhood or as adults in our adultery.

A consultant is a man who knows less about your business than you do and gets paid more for telling you how to run it than you could make out of it if you ran it right instead of the way he told you.

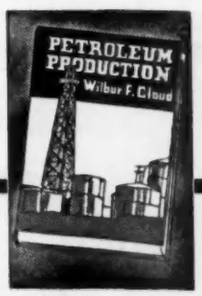
A specialist is a man who concentrates more and more on less and less.

An optimist thinks the future is uncertain.

A pessimist is afraid the optimist is right.

An economist is a man who can make a simple subject complex, a complex subject simple; in other words, an economist is simply simple.

PETROLEUM PRODUCTION



By WILBUR F. CLOUD

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Notes for the Equipment Buyer and User

Welding Cables

NATIONAL CYLINDER GAS COMPANY

National Cylinder Gas Company, Chicago, has announced new solderless connectors and lugs for welding cables. Ease and speed of shop or field installation, complete safety, full protection of cables, and the conservation of vital materials are the principal advantages claimed for the new Cable-Tite connectors and lugs.

The body of standard Cable-Tite connectors is one piece. The "quick" models, recommended for use where the whip-end and main cables connect, have a two-piece body. A slight twist while connecting locks the body into one unit.

Soldering is eliminated—saving material, labor and time. To install a Cable-Tite in the shop takes but two or three minutes; in the field takes only five minutes.

Compression collar grips the cable-end and shapes it into a head which cannot work out or be pulled out of the fitting.

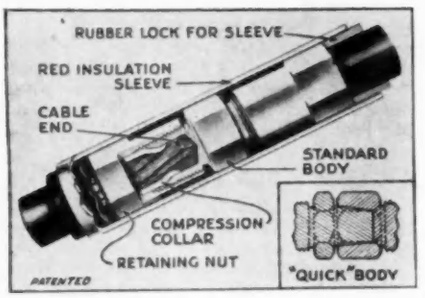
The conductivity of a Cable-Tite fitting is greater than the cable, resulting in cool operation and increased life for the cable.

Fittings are ruggedly built to stand rough use. Outlasts cable, may be used again and again simply by replacing compression ring when being installed on a new cable length.

After initial installation, cable lengths may be connected or disconnected by hand. Nut swivels so that cable is not twisted.

Heavy-duty insulation sleeve, held by soft rubber locks, assures safe operation and entirely eliminates taping.

Insulating sleeve is bright red in color — makes Cable-Tite connectors easy to locate.



Ease of connecting and disconnecting makes it practical to switch cable lengths periodically so that wear is uniform, thereby increasing cable life.

Bearings

Bantam Bearings Corporation, South Bend, Indiana, has issued data on bearing sizes, load capacities, shaft diameters, and housing bores for the Bantam quill bearing in convenient form in a handy Selectograf.

One side of the Selectograf gives inner and outer race data when the slide is set to the required shaft diameter. The Selectograf then gives the catalog number of outer and inner races; bearing O.D., tolerances, and width; load capacity at 0 and 100 r.p.m. and in oscillation; housing bore and tolerances; and maximum fillet for shaft and housing.

The other side of the Selectograf gives outer race data when slide is set to the inner race O.D. or shaft diameter. Engineers and designers may obtain the Selectograf free of charge by request on their business letterhead.

War Plant Umbrellas

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania, has announced development of a wire "umbrella" to shield vital explosives plants and oil storage centers from lightning.

It is already being used by some war industries and one huge ordnance plant. Using a minimum of strategic materials, the shield deflects lightning driving earthward at more than 11 million miles a minute.

The shield consists simply of a steel wire strung above the building to be protected and anchored on tall wood poles at each end. The wire is then connected to steel rods buried in the ground.

This method saves copper for other war uses. Previously explosives plants or oil depots were guarded by lightning rods which required about 250 pounds of copper attached to the building and buried in the surrounding ground. An umbrella for the same building can be erected with only 60 pounds of steel and two wood poles. With the new design danger of lightning leaping to metal sections of the building and causing sparks has been eliminated.

Studies of lightning strokes on power lines show that each square mile of sky hurls about 10 thunderbolts at the ground each year. Modern ordnance plants have several hundred buildings spread over a large area so each plant will be a target for lightning several times a year. Just one of those strokes could cause a disastrous explosion or fire if proper protective devices were lacking.

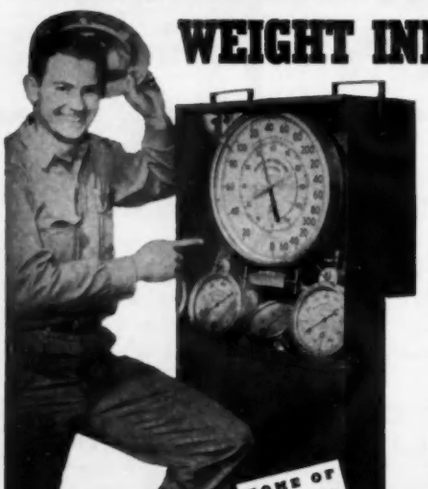
Another lightning protection plan suggested surrounds the building with six poles 10 feet higher than the roof. Steel wires extending from the top of each pole attract lightning from the area above the structure so that an invisible lightning-proof "blanket" is suspended over the roof. Thunderbolts are drawn to the steel tips of the poles and thence to the ground.

Westinghouse engineers know the character of lightning from data collected in the field by fulchronographs mounted atop fire towers, power lines and radio transmission masts. Lightning striking these structures is led to the fulchronograph which has a constantly revolving wheel. On the rim of the wheel are metal blades which are magnetized by the lightning. The number of blades magnetized and the amount of magnetism in each gives engineers a picture of the thunderbolt.

Blaine Cole Killed in African Invasion

A blue star has been replaced by a gold star in Axelson Manufacturing Company's service flag in Los Angeles, honoring Lieutenant Blaine Cole.

Lieutenant Cole, former engineer for Axelson, was the first man from Los Angeles killed in the Allied invasion of North Africa. As an officer engineer in the amphibious forces, he was reported



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